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EDITED BY

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BORDERED ANTILOGARITHMS. TRIGONOMETRIC LOGARITHMS TO EVERY TWO MINUTES. NATURAL FUNCTIONS ON THREE PAGES. TABLES OF EXACT SQUARES.

BY G. H. BRYAN.

With the assistance of CARADOG WILLIAMS, T. G. CREAK, M.A., VIOLET JAMES and others.

EXPLANATION OF THE TABLES.

ALTHOUGH books of mathematical tables have appeared by the dozen in recent years, most of them show little or no evidence of originality in the matter of arrangement. One of the most common characteristics of such tables is that much space is taken up with unnecessary repetition, as when both logarithms and antilogarithms, squares and square roots, or sines and cosines of all circles from 0° to 90° are separately tabulated, while the information supplied in other directions is defective, as when logarithms of reciprocals are omitted and tables of squares fail to give the correct values of the squares of integers.

The Bordered Antilogarithm Table was published in the *Mathematical Gazette* for December, 1915, and several correspondents expressed a wish that other tables should also be drawn up embodying improvements in arrangement proposed by me. This has now been done, and I have to thank those associated with my name on the titles for the whole work of making the necessary tabulations. It is interesting to note that the method of tabulation introduced in the Bordered Antilogarithm Table has already been adopted in a set of tables published for use on board the training ship *Conway*.

I. *The Bordered Antilogarithm Table* (pp. 336, 337). It is unnecessary to tabulate logarithms and antilogarithms separately, as both can be obtained by the direct and inverse use of a single table. The advantages of obtaining logarithms by the inverse method from a table of antilogarithms are as follows:

1. Both logarithms of numbers and the logarithms of their reciprocals can be read off from the same table in the same way that the sine of an angle and the cosine of its complement can be tabulated in a single

entry. The left-hand column and top line give the logarithms of the numbers entered in the area, the right-hand column and bottom line give the logarithms of the reciprocals, the fourth figure being read off from the table of proportional parts.

The characteristic of the logarithm of a number is found by counting the places from the highest significant figure to the units place, and is negative if the highest significant figure is to the *right* of the units place. The characteristic of the logarithm of the reciprocal of a number is found by counting places from the *first place of decimals* to the highest significant figure, and is negative if the highest significant figure is to the *left* of the units place.

2. To determine the logarithm of a number correctly to four places of decimals, the number must be known (at least approximately) to *five* significant figures in the lower parts of the scale, but in the upper parts it is useless to know it to more than *four* significant figures. The tables are arranged on this basis, and it will be seen that both large and small differences are thereby avoided. The only place where the same difference occurs in two columns of the table of proportional parts is in the first line of page 337, but in this case the ambiguity is avoided by using the last line of page 336.

II. *Short tables of logarithms and logarithms of reciprocals* (foot of p. 337). This will be found very useful in giving in a very concise form the logarithms of numbers of two digits and of a few important constants. These are given to five places as there was sufficient room for this number. The fifth figure when known will be found useful for the purposes of carrying, or if preferred we may, for example, write down the logarithm of 27 as 1·4314 instead of 1·43136.

III. *Trigonometric Logarithms* (pp. 338 to 347). The arrangement of the present table possesses the following advantages:

1. The logarithms of the six trigonometric ratios of an angle are all given on a pair of facing pages. This obviates the necessity of turning over the pages, for example, when the logarithms are required of both the sine and cosine of the same angle, or again when an angle has to be determined from its log tangent and its log sine is then required.

2. Although the tables only occupy *ten pages*, as against twelve in many of the existing collections, the logarithms are tabulated *for every two minutes of angle*, except between 0° and 5°, where they are tabulated for every minute except in the case of the secant and cosine which vary very slowly.

Interpolation is therefore unnecessary except when the number of minutes is odd, in which case the arithmetical mean of the entries for the previous and succeeding even minutes must be taken. It is a pity that the pages do not contain room for the difference for 1′ to be tabulated.

The retention of the "added ten" helps to remind us of the historical fact that the trigonometric functions of the earliest tables were not ratios but *lengths* referred to *arcs* of a circle of radius 10^{10}. Otherwise this feature possesses no substantial advantage or disadvantages as against the use of negative characteristics.

The order of arrangement, which differs slightly from that of Chambers' tables, was determined by considerations of space. It has, however, the additional advantage that increasing and decreasing functions are tabulated on opposite pages, and that the logarithms on the right-hand page are the complements of those on the corresponding line and column on the left-hand page.

IV. *Tables of Exact Squares* (pp. 348, 349. The so-called tables of squares contained in existing books do not really give the squares of the numbers tabulated, but only approximations for the first four (or five) figures of the squares of decimal fractions. Such tables are therefore useless for squaring integers, and they are only useful for finding square roots when these have to be taken to not more than four (or five) places. In this table the exact values are given for the squares of all numbers of three digits.

Thus in a table before me the square of 8·66 is given as 75·00, which would make the square of 866 to be 750,000, which is incorrect. The present table gives the correct value 749,956.

To find the square of a number of more than three digits we use the property $(N+x)^2=N^2+(2N+x)\times x$; again the table gives the first three digits of the square root of any number, and successive digits can then be calculated indefinitely if ever this process is required. The table gives the values of $2N$ in the bottom line and right-hand column, the asterisked numbers corresponding to one another. For example, to find the square of 3968 and the square root of 2 we may proceed as follows:

$$N^2 = 3960^2 = 15681600$$
$$(2N+x)\times x = 7928\times 8 = \underline{\quad 63424}$$
$$(N+x)^2 = 3768^2 = 15745024$$

Again

$$\begin{array}{r|l} 2{\cdot}000000 & (\ 1{\cdot}41 \\ \underline{1{\cdot}988100} & \\ 2824\ ) \ 0{\cdot}011900 & (\ 4 \\ \underline{\quad 11296} & \end{array}$$

Ans. 1·414... etc.

V. *Tables of Natural Functions* (pp. 350-352). These are not often required in calculations requiring any great accuracy, because in problems like the solution of triangles, operations of multiplication and division have to be performed, for which logarithms are usually essential. It therefore becomes desirable to discourage pupils from using the natural functions (which they are prone to do even in the most unsuitable cases), and we have only tabulated them for every 10′ of angle, which enables the whole collection to be got onto three pages. In regard to order of arrangement the secants and cosecants are the functions which are most seldom used, and for this reason these are the two for which it is necessary to turn overleaf. The insertion of two columns of differences was primarily suggested by considerations of symmetry, but this feature will be found helpful in cases in which the differences change rapidly. In such cases it must be left to the discretion of individual workers to decide whether they desire to adopt rough and ready rules for determining the proportional parts, or whether they prefer to give themselves additional trouble about a small possible error in the fourth place of decimals.

ANTILOGARITHMS.

Index or Log.	0	1	2	3	4	5	6	7	8	9	10	Differences. 1	2	3	4	5	6	7	8	9	
·00	10000	022	046	069	093	116	139	162	186	209	10233	2	5	7	9	12	14	16	19	21	·99
·01	10233	257	280	304	328	351	375	399	423	447	10471	2	5	7	10	12	14	17	19	21	·98
·02	10471	495	520	544	568	593	617	641	666	691	10715	2	5	7	10	12	15	17	20	22	·97
·03	10715	740	765	789	814	839	864	889	914	940	10965	3	5	8	10	13	15	18	20	23	·96
·04	10965	990	015	041	066	092	117	143	169	194	11220	3	5	8	10	13	15	18	20	23	·95
·05	11220	246	272	298	324	350	376	402	429	455	11482	3	5	8	11	13	16	18	21	24	·94
·06	11482	508	535	561	588	614	641	668	695	722	11749	3	5	8	11	13	16	19	21	24	·93
·07	11749	776	803	830	858	885	912	940	967	995	12023	3	5	8	11	14	16	19	22	25	·92
·08	12023	050	078	106	134	162	190	218	246	274	12303	3	6	8	11	14	17	20	22	25	·91
·09	12303	331	359	388	417	445	474	503	531	560	12589	3	6	9	11	14	17	20	23	26	·90
·10	12589	618	647	677	706	735	764	794	823	853	12882	3	6	9	12	15	18	21	24	26	·89
·11	12882	912	942	972	002	032	062	092	122	152	13183	3	6	9	12	15	18	21	24	27	·88
·12	13183	213	243	274	305	335	366	397	428	459	13490	3	6	9	12	15	18	21	25	28	·87
·13	13490	521	552	583	614	646	677	709	740	772	13804	3	6	9	13	16	19	22	25	28	·86
·14	13804	836	868	900	932	964	996	028	060	093	14125	3	6	10	13	16	19	22	26	29	·85
·15	14125	158	191	223	256	289	322	355	388	421	14454	3	7	10	13	16	20	23	26	30	·84
·16	14454	488	521	555	588	622	655	689	723	757	14791	3	7	10	13	17	20	24	27	30	·83
·17	14791	825	859	894	928	962	997	031	066	101	15136	3	7	10	14	17	21	24	28	31	·82
·18	15136	171	205	241	276	311	346	382	417	453	15488	4	7	11	14	18	21	25	28	32	·81
·19	15488	524	560	596	631	668	704	740	776	812	15849	4	7	11	14	18	22	25	29	32	·80
·20	15849	885	922	959	996	032	069	106	144	181	16218	4	7	11	15	18	22	26	30	33	·79
·21	16218	255	293	331	368	406	444	482	520	558	16596	4	8	11	15	19	23	26	30	34	·78
·22	16596	634	672	711	749	788	827	866	904	943	16982	4	8	12	15	19	23	27	31	35	·77
·23	16982	022	061	100	140	179	219	258	298	338	17378	4	8	12	16	20	24	28	32	36	·76
·24	17378	418	458	498	539	579	620	660	701	742	17783	4	8	12	16	20	24	28	32	36	·75
·25	17783	824	865	906	947	989	030	072	113	155	18197	4	8	12	17	21	25	29	33	37	·74
·26	18197	239	281	323	365	408	450	493	535	578	18621	4	8	13	17	21	25	30	34	38	·73
·27	18621	664	707	750	793	836	880	923	967	011	19055	4	9	13	17	22	26	30	35	39	·72
·28	19055	099	143	187	231	275	320	364	409	454	19498	4	9	13	18	22	26	31	35	40	·71
·29	19498	543	588	634	679	724	770	815	861	907	19953	5	9	14	18	23	27	32	36	41	·70
·30	19953	999	045	091	137	184	230	277	324	370	20417	5	9	14	19	23	28	32	37	42	·69
·31	20417	464	512	559	606	654	701	749	797	845	20893	5	10	14	19	24	29	33	38	43	·68
·32	20893	941	989	038	086	135	184	232	281	330	21380	5	10	15	19	24	29	34	39	44	·67
·33	21380	429	478	528	577	627	677	727	777	827	21878	5	10	15	20	25	30	35	40	45	·66
·34	21878	928	979	029	080	131	182	233	284	336	22387	5	10	15	29	25	31	36	41	46	·65
·35	22387	439	491	542	594	646	699	751	803	856	22909	5	10	16	21	26	31	37	42	47	·64
·36	22909	961	014	067	121	174	227	281	336	388	23442	5	11	16	21	27	32	37	43	48	·63
·37	23442	496	550	605	659	714	768	823	878	933	23988	5	11	16	22	27	33	38	44	49	·62
·38	23988	044	099	155	210	266	322	378	434	491	24547	6	11	17	22	28	34	39	45	50	·61
·39	24547	604	660	717	774	831	889	946	006	061	25119	6	11	17	23	29	34	40	46	51	·60
·40	25119	177	236	293	351	410	468	527	586	645	25704	6	12	18	23	29	35	41	47	53	·59
·41	25704	763	823	882	942	002	062	122	182	242	26303	6	12	18	24	30	36	42	48	54	·58
·42	26303	363	424	485	546	607	669	730	792	853	26915	6	12	18	24	31	37	43	49	55	·57
·43	26915	977	040	102	164	227	290	353	416	479	27542	6	13	19	25	31	38	44	50	56	·56
·44	27542	606	669	733	797	861	925	990	054	119	28184	6	13	19	26	32	39	45	51	58	·55
·45	28184	249	314	379	445	510	576	642	708	774	28840	7	13	20	26	33	39	46	52	59	·54
·46	28840	907	973	040	107	174	242	309	376	444	29512	7	13	20	27	34	40	47	54	60	·53
·47	29512	580	648	717	785	854	923	992	061	130	30200	7	14	21	28	34	41	48	55	62	·52
·48	30200	259	339	409	479	549	620	690	761	832	30903	7	14	21	28	35	42	49	56	63	·51
·49	30903	974	046	117	189	261	333	405	477	550	31623	7	14	22	29	36	43	50	58	65	·50
·50	31623	696	769	842	916	989	063	137	211	285	32359	7	15	22	29	37	44	52	59	66	·49
·51	32359	434	509	584	659	735	809	885	961	037	33113	8	15	23	30	38	45	53	60	68	·48
·52	33113	189	266	343	420	497	574	651	729	806	33884	8	15	23	31	39	46	54	62	69	·47
·53	33884	963	041	119	198	277	356	435	514	594	34674	8	16	24	32	40	47	55	63	71	·46
·54	34674	754	834	914	995	075	156	237	318	400	35481	8	16	24	32	40	48	56	65	73	·45
·55	35481	563	645	727	810	892	975	058	141	224	36308	8	16	25	33	41	50	58	66	74	·44
·56	36308	392	475	559	644	728	813	898	983	068	37154	8	17	25	34	42	51	59	68	76	·43
·57	37154	239	325	411	497	584	670	757	844	931	38019	9	17	26	35	43	52	61	69	78	·42
·58	38019	107	194	282	371	459	548	637	726	815	38905	9	18	27	35	44	53	62	71	80	·41
·59	38905	994	084	174	264	355	446	537	628	719	39811	9	18	27	36	45	54	63	72	82	·40
·60	39811	902	994	087	179	272	365	458	551	644	40738	9	19	28	37	46	56	65	74	83	·39
	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	Colog
												Differences.									

ANTILOGARITHMIC RECIPROCALS.

ANTILOGARITHMIC RECIPROCALS.

ANTILOGARITHMS.

ANTILOGARITHMS.

Index or Log.	0	1	2	3	4	5	6	7	8	9	10	Differences. 1	2	3	4	5	6	7	8	9	
·60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	4074	1	2	3	4	5	6	7	7	8	·39
·61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	4169	1	2	3	4	5	6	7	8	9	·38
·62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	4266	1	2	3	4	5	6	7	8	9	·37
·63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	4365	1	2	3	4	5	6	7	8	9	·36
·64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	4467	1	2	3	4	5	6	7	8	9	·35
·65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	4571	1	2	3	4	5	6	7	8	9	·34
·66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	4677	1	2	3	4	5	6	7	9	10	·33
·67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	4786	1	2	3	4	5	7	8	9	10	·32
·68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	4898	1	2	3	4	6	7	8	9	10	·31
·69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	5012	1	2	3	5	6	7	8	9	10	·30
·70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	5129	1	2	4	5	6	7	8	9	11	·29
·71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	5248	1	2	4	5	6	7	8	10	11	·28
·72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	5370	1	2	4	5	6	7	9	10	11	·27
·73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	5495	1	3	4	5	6	8	9	10	11	·26
·74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	5623	1	3	4	5	6	8	9	10	12	·25
·75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	5754	1	3	4	5	7	8	9	10	12	·24
·76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	5888	1	3	4	5	7	8	9	11	12	·23
·77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	6026	1	3	4	5	7	8	10	11	12	·22
·78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	6166	1	3	4	6	7	8	10	11	13	·21
·79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	6310	1	3	4	6	7	9	10	12	13	·20
·80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	6457	1	3	4	6	7	9	10	12	13	·19
·81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	6607	2	3	5	6	8	9	11	12	14	·18
·82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	6761	2	3	5	6	8	9	11	12	14	·17
·83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	6918	2	3	5	6	8	10	11	13	14	·16
·84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	7079	2	3	5	6	8	10	11	13	15	·15
·85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	7244	2	3	5	7	8	10	12	13	15	·14
·86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	7413	2	3	5	7	9	10	12	14	15	·13
·87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	7586	2	3	5	7	9	10	12	14	16	·12
·88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	7762	2	4	5	7	9	11	12	14	16	·11
·89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	7943	2	4	5	7	9	11	13	15	16	·10
·90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	8128	2	4	6	7	9	11	13	15	17	·09
·91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	8318	2	4	6	8	10	11	13	15	17	·08
·92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	8511	2	4	6	8	10	12	14	15	17	·07
·93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	8710	2	4	6	8	10	12	14	16	18	·06
·94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	8913	2	4	6	8	10	12	14	16	18	·05
·95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	9120	2	4	6	8	10	12	15	17	19	·04
·96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	9333	2	4	6	8	11	13	15	17	19	·03
·97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	9550	2	4	7	9	11	13	15	17	20	·02
·98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	9772	2	4	7	9	11	13	16	18	20	·01
·99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	10000	2	5	7	9	11	14	16	18	20	·00
	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	Colog
												Differences.									

ANTILOGARITHMIC RECIPROCALS.

ANTILOGARITHMIC RECIPROCALS.

LOGARITHMS 10 TO 99.

	0	1	2	3	4	5	6	7	8	9
1	00000	04139	07918	11394	14613	17609	20412	23045	25527	27875
2	30103	32222	34242	36173	38021	39794	41497	43136	44716	46240
3	47712	49136	50515	51851	53148	54407	55630	56820	57978	59106
4	60206	61278	62325	63347	64345	65321	66276	67210	68124	69020
5	69897	70757	71600	72428	73239	74036	74819	75587	76343	77085
6	77815	78533	79239	79934	80618	81291	81954	82607	83251	83885
7	84510	85126	85733	86332	86923	87506	88081	88649	89209	89763
8	90309	90849	91381	91908	92428	92942	93450	93952	94448	94939
9	95424	95904	96379	96848	97313	97772	98227	98677	99123	99564

N	Log N
π	0·49715
180/π	1·75812
e	43429
$\text{Log}_{10}e$	1·63778
Water d. 62·3	1·79449
$g=32\,2$	1·50786
$g=981$	2·99167
Speed 88/60	0·16633
Ton 2240	3·35025
Mile 5280	3·72263

LOGARITHMS OF RECIPROCALS.

	0	1	2	3	4	5	6	7	8	9
·1	100000	95861	92082	88606	85387	82391	79588	76955	74473	72125
·2	69897	67778	65758	63827	61979	60206	58503	56864	55284	53760
·3	52288	50864	49485	48149	46852	45593	44370	43180	42022	40894
·4	39794	38722	37675	36653	35655	34679	33724	32790	31876	30980
·5	30103	29243	28400	27572	26761	25964	25181	24413	23657	22915
·6	22185	21467	20761	20066	19382	18709	18045	17393	16749	16115
·7	15490	14874	14267	13668	13077	12494	11919	11351	10791	10237
·8	09691	09152	08619	08092	07572	07058	06550	06048	05552	05061
·9	04576	04096	03621	03152	02687	02228	01773	01323	00877	00436

N	Log 1/N
π	$\bar{1}$·50285
180/π	2·24188
e	$\bar{1}$·56571
$\text{Log}_{10}e$	0·36222
Water d. 62·3	2·20551
$g=32\cdot2$	2·49214
$g=981$	3·00833
Speed 88/60	$\bar{1}$·83367
Ton 2240	$\bar{4}$·64975
Mile 5280	$\bar{4}$·27737

0° to 5°	L. SINES.						L. TANGENTS.						L. SECS.	
	0′	1′	2′	3′	4′	5′	0′	1′	2′	3′	4′	5′		
0° 0′	−∞	6·4637	7648	9408	0658	7·1627	−∞	6·4637	7648	9408	0658	7·1627	10·0000	89° 55′
5′	7·1627	2419	3088	3668	4180	7·4637	7·1627	2419	3088	3668	4180	7·4637	10·0000	50′
10′	7·4637	5051	5429	5777	6099	7·6398	7·4637	5051	5429	5777	6099	7·6398	10·0000	45′
15′	7·6398	6678	6942	7190	7425	7·7648	7·6398	6678	6942	7190	7425	7·7648	10·0000	40′
20′	7·7648	7859	8061	8255	8439	7·8617	7·7648	7860	8062	8255	8439	7·8617	10·0000	35′
25′	7·8617	›787	8951	9109	9261	7·9408	7·8617	8787	8951	9109	9261	7·9409	10·0000	30′
30′	7·9408	9551	9689	9822	9952	8·0078	7·9409	9551	9689	9823	9952	8·0078	10·0000	25′
35′	8·0078	0200	0319	0435	0548	8·0658	8·0078	0200	0319	0435	0548	8·0658	10·0000	20′
40′	8·0658	0765	0870	0972	1072	8·1169	8·0658	0765	0870	0972	1072	8·1170	10·0000	15′
45′	8·1169	1265	1358	1450	1539	8·1627	8·1170	1265	1359	1450	1540	8·1627	10·0000	10′
50′	8·1627	1713	1797	1880	1961	8·2041	8·1627	1713	1798	1880	1962	8·2041	10·0001	5′
0° 55′	8·2041	2119	2196	2271	2346	8·2419	8·2041	2120	2196	2272	2346	8·2419	10·0001	89° 0′
1° 0′	8·2419	2490	2561	2630	2699	8·2766	8·2419	2491	2562	2631	2700	8·2767	10·0001	88° 55′
5′	8·2766	2832	2898	2962	3025	8·3088	8·2767	2833	2899	2963	3026	8·3089	10·0001	50′
10′	8·3088	3150	3210	3270	3329	8·3388	8·3089	3150	3211	3271	3330	8·3389	10·0001	45′
15′	8·3388	3445	3502	3558	3613	8·3668	8·3389	3446	3503	3559	3614	8·3669	10·0001	40′
20′	8·3668	3722	3775	3828	3880	8·3931	8·3669	3723	3776	3829	3881	8·3932	10·0001	35′
25′	8·3931	3982	4032	4082	4131	8·4179	8·3932	3983	4033	4083	4132	8·4181	10·0001	30′
30′	8·4179	4227	4275	4322	4368	8·4414	8·4181	4229	4276	4323	4370	8·4416	10·0002	25′
35′	8·4414	4459	4504	4549	4593	8·4637	8·4416	4461	4506	4551	4595	8·4638	10·0002	20′
40′	8·4637	4680	4723	4765	4807	8·4848	8·4638	4682	4725	4767	4809	8·4851	10·0002	15′
45′	8·4848	4890	4930	4971	5011	8·5050	8·4851	4892	4933	4973	5013	8·5053	10·0002	10′
50′	8·5050	5090	5129	5167	5206	8·5243	8·5053	5092	5131	5170	5208	8·5246	10·0002	5′
1° 55′	8·5243	5281	5318	5355	5392	8·5428	8·5246	5283	5321	5358	5394	8·5431	10·0003	88° 0′
2° 0′	8·5428	5464	5500	5535	5571	8·5605	8·5431	5467	5503	5538	5573	8·5608	10·0003	87° 55′
5′	8·5605	5640	5674	5708	5742	8·5776	8·5608	5643	5677	5711	5745	8·5779	10·0003	50′
10′	8·5776	5809	5842	5875	5907	8·5939	8·5779	5812	5845	5878	5911	8·5943	10·0003	45′
15′	8·5939	5972	6003	6035	6066	8·6097	8·5943	5975	6007	6038	6070	8·6101	10·0004	40′
20′	8·6097	6128	6159	6189	6220	8·6250	8·6101	6132	6163	6193	6223	8·6254	10·0004	35′
25′	8·6250	6279	6309	6339	6368	8·6397	8·6254	6283	6313	6343	6372	8·6401	10·0004	30′
30′	8·6397	6426	6454	6483	6511	8·6539	8·6401	6430	6459	6487	6515	8·6544	10·0004	25′
35′	8·6539	6567	6595	6622	6650	8·6677	8·6544	6571	6599	6627	6654	8·6682	10·0005	20′
40′	8·6677	6704	6731	6758	6784	8·6810	8·6682	6709	6736	6762	6789	8·6815	10·0005	15′
45′	8·6810	6837	6863	6889	6914	8·6940	8·6815	6842	6868	6894	6920	8·6945	10·0005	10′
50′	8·6940	6965	6991	7016	7041	8·7066	8·6945	6971	6996	7021	7046	8·7071	10·0006	5′
2° 55′	8·7066	7090	7115	7140	7164	8·7188	8·7071	7096	7121	7145	7170	8·7194	10·0006	87° 0′
3° 0′	8·7188	7212	7236	7260	7283	8·7307	8·7194	7218	7242	7266	7290	8·7313	10·0006	86° 55′
5′	8·7307	7330	7354	7377	7400	8·7423	8·7313	7337	7360	7383	7406	8·7429	10·0007	50′
10′	8·7423	7445	7468	7491	7513	8·7535	8·7429	7452	7475	7497	7520	8·7542	10·0007	45′
15′	8·7535	7557	7580	7602	7623	8·7645	8·7542	7565	7587	7609	7631	8·7652	10·0007	40′
20′	8·7645	7667	7688	7710	7731	8·7752	8·7652	7674	7696	7717	7739	8·7760	10·0008	35′
25′	8·7752	7773	7794	7815	7836	8·7857	8·7760	7781	7802	7823	7844	8·7865	10·0008	30′
30′	8·7857	7877	7898	7918	7939	8·7959	8·7865	7886	7906	7927	7947	8·7967	10·0008	25′
35′	8·7959	7979	7999	8019	8039	8·8059	8·7967	7988	8008	8028	8048	8·8067	10·0009	20′
40′	8·8059	8078	8098	8117	8137	8·8156	8·8067	8087	8107	8126	8146	8·8165	10·0009	15′
45′	8·8156	8175	8194	8213	8232	8·8251	8·8165	8185	8204	8223	8242	8·8261	10·0010	10′
50′	8·8251	8270	8289	8307	8326	8·8345	8·8261	8280	8299	8317	8336	8·8355	10·0010	5′
3° 55′	8·8345	8363	8381	8400	8418	8·8436	8·8355	8373	8392	8410	8428	8·8446	10·0011	86° 0′
4° 0′	8·8436	8454	8472	8490	8508	8·8525	8·8446	8465	8483	8501	8518	8·8536	10·0011	85° 55′
5′	8·8525	8543	8560	8578	8595	8·8613	8·8536	8554	8572	8589	8607	8·8624	10·0011	50′
10′	8·8613	8630	8647	8665	8682	8·8699	8·8624	8642	8659	8676	8694	8·8711	10·0012	45′
15′	8·8699	8716	8733	8749	8766	8·8783	8·8711	8728	8745	8762	8778	8·8795	10·0012	40′
20′	8·8783	8799	8816	8833	8849	8·8865	8·8795	8812	8829	8845	8862	8·8878	10·0013	35′
25′	8·8865	8882	8898	8914	8930	8·8946	8·8878	8895	8911	8927	8944	8·8960	10·0013	30′
30′	8·8946	8962	8978	8994	9010	8·9026	8·8960	8976	8992	9008	9024	8·9040	10·0014	25′
35′	8·9026	9042	9057	9073	9089	8·9104	8·9040	9056	9071	9087	9103	8·9118	10·0014	20′
40′	8·9104	9119	9135	9150	9166	8·9181	8·9118	9134	9150	9165	9180	8·9196	10·0015	15′
45′	8·9181	9196	9211	9226	9241	8·9256	8·9196	9211	9226	9241	9256	8·9272	10·0015	10′
50′	8·9256	9271	9286	9301	9315	8·9330	8·9272	9287	9302	9316	9331	8·9346	10·0016	5′
4° 55′	8·9330	9345	9359	9374	9388	8·9403	8·9346	9361	9376	9390	9405	8·9420	10·0017	85° 0′
	5′	4′	3′	2′	1′	0′	5′	4′	3′	2′	1′	0′		85° to 90°
	L. COSINES.						L. COTANGENTS.						L. COSECS.	

LOGARITHMIC COSINES, COTANGENTS AND COSECANTS.

0° to 5°	L. COSECANTS.						L. COTANGENTS.						L. COSINES.	
	0′	1′	2′	3′	4′	5′	0	1′	2′	3′	4′	5′		
0° 0′	∝	13·5363	2352	0592	9342	12·8373	∞	13·5363	2352	0592	9342	12·8373	10·0000	89° 55′
5′	12·8373	7581	6912	6332	5820	12·5363	12·8373	7581	6912	6332	5820	12·5363	10·0000	50′
10′	12·5363	4949	4571	4223	3901	12·3602	12·5363	4949	4571	4223	3901	12·3602	10·0000	45′
15′	12·3602	3322	3058	2810	2575	12·2352	12·3602	3322	3058	2810	2575	12·2352	10·0000	40′
20′	12·2352	2141	1939	1745	1561	12·1383	12·2352	2140	1938	1745	1561	12·1383	10·0000	35′
25′	12·1383	1213	1049	0891	0739	12·0592	12·1383	1213	1049	0891	0739	12·0591	10·0000	30′
30′	12·0592	0449	0311	0178	0048	11·9922	12·0591	0449	0311	0177	0048	11·9922	10·0000	25′
35′	11·9922	9800	9681	9565	9452	11·9342	11·9922	9800	9681	9565	9452	11·9342	10·0000	20′
40′	11·9342	9235	9130	9028	8928	11·8831	11·9342	9235	9130	9028	8928	11·8830	10·0000	15′
45′	11·8831	8735	8642	8550	8461	11·8373	11·8830	8735	8641	8550	8460	11·8373	10·0000	10′
50′	11·8373	8287	8203	8120	8039	11·7959	11·8373	8287	8202	8120	8038	11·7959	9·9999	5′
0° 55′	11·7959	7881	7804	7729	7654	11·7581	11·7959	7880	7804	7728	7654	11·7581	9·9999	89° 0′
1° 0′	11·7581	7510	7439	7370	7301	11·7234	11·7581	7509	7438	7369	7300	11·7233	9·9999	88° 55′
5′	11·7234	7168	7102	7038	6975	11·6912	11·7233	7167	7101	7037	6974	11·6911	9·9999	50′
10′	11·6912	6850	6790	6730	6671	11·6612	11·6911	6850	6789	6729	6670	11·6611	9·9999	45′
15′	11·6612	6555	6498	6442	6387	11·6332	11·6611	6554	6497	6441	6386	11·6331	9·9999	40′
20′	11·6332	6278	6225	6172	6120	11·6069	11·6331	6277	6224	6171	6119	11·6068	9·9999	35′
25′	11·6069	6018	5968	5918	5869	11·5821	11·6068	6017	5967	5917	5868	11·5819	9·9999	30′
30′	11·5821	5773	5725	5678	5632	11·5586	11·5819	5771	5724	5677	5630	11·5584	9·9998	25′
35′	11·5586	5541	5496	5451	5407	11·5363	11·5584	5539	5494	5449	5405	11·5362	9·9998	20′
40′	11·5363	5320	5277	5235	5193	11·5152	11·5362	5318	5275	5233	5191	11·5149	9·9998	15′
45′	11·5152	5110	5070	5029	4989	11·4950	11·5149	5108	5067	5027	4987	11·4947	9·9998	10′
50′	11·4950	4910	4871	4833	4794	11·4757	11·4947	4908	4869	4830	4792	11·4754	9·9998	5′
1° 55′	11·4757	4719	4682	4645	4608	11·4572	11·4754	4717	4679	4642	4606	11·4569	9·9997	88° 0′
2° 0′	11·4572	4536	4500	4465	4429	11·4395	11·4569	4533	4497	4462	4427	11·4392	9·9997	87° 55′
5′	11·4395	4360	4326	4292	4258	11·4224	11·4392	4357	4323	4289	4255	11·4221	9·9997	50′
10′	11·4224	4191	4158	4125	4093	11·4061	11·4221	4188	4155	4122	4089	11·4057	9·9997	45′
15′	11·4061	4028	3997	3965	3934	11·3903	11·4057	4025	3993	3962	3930	11·3899	9·9996	40′
20′	11·3903	3872	3841	3811	3780	11·3750	11·3899	3868	3837	3807	3777	11·3746	9·9996	35′
25′	11·3750	3721	3691	3661	3632	11·3603	11·3746	3717	3687	3657	3628	11·3599	9·9996	30′
30′	11·3603	3574	3546	3517	3489	11·3461	11·3599	3570	3541	3513	3485	11·3456	9·9996	25′
35′	11·3461	3433	3405	3378	3350	11·3323	11·3456	3429	3401	3373	3346	11·3318	9·9995	20′
40′	11·3323	3296	3269	3242	3216	11·3190	11·3318	3291	3264	3238	3211	11·3185	9·9995	15′
45′	11·3190	3163	3137	3111	3086	11·3060	11·3185	3158	3132	3106	3080	11·3055	9·9995	10′
50′	11·3060	3035	3009	2984	2959	11·2934	11·3055	3029	3004	2979	2954	11·2929	9·9994	5′
2° 55′	11·2934	2910	2885	2860	2836	11·2812	11·2929	2904	2879	2855	2830	11·2806	9·9994	87° 0′
3° 0′	11·2812	2788	2764	2740	2717	11·2693	11·2806	2782	2758	2734	2710	11·2687	9·9994	86° 55′
5′	11·2693	2670	2646	2623	2600	11·2577	11·2687	2663	2640	2617	2594	11·2571	9·9993	50′
10′	11·2577	2555	2532	2509	2487	11·2465	11·2571	2548	2525	2503	2480	11·2458	9·9993	45′
15′	11·2465	2443	2420	2398	2377	11·2355	11·2458	2435	2413	2391	2369	11·2348	9·9993	40′
20′	11·2355	2333	2312	2290	2269	11·2248	11·2348	2326	2304	2283	2261	11·2240	9·9992	35′
25′	11·2248	2227	2206	2185	2164	11·2143	11·2240	2219	2198	2177	2156	11·2135	9·9992	30′
30′	11·2143	2123	2102	2082	2061	11·2041	11·2135	2114	2094	2073	2053	11·2033	9·9992	25′
35′	11·2041	2021	2001	1981	1961	11·1941	11·2033	2012	1992	1972	1952	11·1933	9·9991	20′
40′	11·1941	1922	1902	1883	1863	11·1844	11·1933	1913	1893	1874	1854	11·1835	9·9991	15′
45′	11·1844	1825	1806	1787	1768	11·1749	11·1835	1815	1796	1777	1758	11·1739	9·9990	10′
50′	11·1749	1730	1711	1693	1674	11·1655	11·1739	1720	1701	1683	1664	11·1645	9·9990	5′
3° 55′	11·1655	1637	1619	1600	1582	11·1564	11·1645	1627	1608	1590	1572	11·1554	9·9989	86° 0′
4° 0′	11·1564	1546	1528	1510	1492	11·1475	11·1554	1535	1517	1499	1482	11·1464	9·9989	85° 55′
5′	11·1475	1457	1440	1422	1405	11·1387	11·1464	1446	1428	1411	1393	11·1376	9·9989	50′
10′	11·1387	1370	1353	1335	1318	11·1301	11·1376	1358	1341	1324	1306	11·1289	9·9988	45′
15′	11·1301	1284	1267	1251	1234	11·1217	11·1289	1272	1255	1238	1222	11·1205	9·9988	40′
20′	11·1217	1201	1184	1167	1151	11·1135	11·1205	1188	1171	1155	1138	11·1122	9·9987	35′
25′	11·1135	1118	1102	1086	1070	11·1054	11·1122	1105	1089	1073	1056	11·1040	9·9987	30′
30′	11·1054	1038	1022	1006	0990	11·0974	11·1040	1024	1008	0992	0976	11·0960	9·9986	25′
35′	11·0974	0958	0943	0927	0911	11·0896	11·0960	0944	0929	0913	0897	11·0882	9·9986	20′
40′	11·0896	0881	0865	0850	0834	11·0819	11·0882	0866	0850	0835	0820	11·0804	9·9985	15′
45′	11·0819	0804	0789	0774	0759	11·0744	11·0804	0789	0774	0759	0744	11·0728	9·9985	10′
50′	11·0744	0729	0714	0699	0685	11·0670	11·0728	0713	0698	0684	0669	11·0654	9·9984	5′
4° 55′	11·0670	0655	0641	0626	0612	11·0597	11·0654	0639	0624	0610	0595	11·0580	9·9983	85° 0′
	5′	4′	3′	2′	1′	0′	5′	4′	3′	2′	1′	0′		85° to 90°
	L. SECANTS.						L. TANGENTS.						L. SINES.	

LOGARITHMIC SECANTS, TANGENTS, AND SINES.

5° to 15°	L. SINES						L. TANGENTS						L. SECANTS						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
5° 0′	8·9403	432	460	489	517	8·9545	8·9420	449	477	506	534	8·9563	10·0017	7	7	7	7	10·0018	84° 50′
10′	8·9545	573	601	628	655	8·9682	8·9563	591	619	646	674	8·9701	10·0018	8	8	8	9	10·0019	40′
20′	8·9682	709	736	763	789	8·9816	8·9701	729	756	782	809	8·9836	10·0019	9	9	0	0	10·0020	30′
30′	8·9816	842	868	894	919	8·9945	8·9836	862	888	915	940	8·9966	10·0020	0	1	1	1	10·0021	20′
40′	8·9945	970	996	021	046	9·0070	8·9966	992	017	043	068	9·0093	10·0021	2	2	2	2	10·0023	10′
5° 50′	9·0070	095	120	144	168	9·0192	9·0093	118	143	167	192	9·0216	10·0023	3	3	3	4	10·0024	84° 0′
6° 0′	9·0192	216	240	264	287	9·0311	9·0216	240	265	289	312	9·0336	10·0024	4	4	5	5	10·0025	83° 50′
10′	9·0311	334	357	380	403	9·0426	9·0336	360	383	407	430	9·0453	10·0025	5	6	6	6	10·0027	40′
20′	9·0426	449	472	494	516	9·0539	9·0453	476	499	521	544	9·0567	10·0027	7	7	7	8	10·0028	30′
30′	9·0539	561	583	605	626	9·0648	9·0567	589	611	633	656	9·0678	10·0028	8	9	9	9	10·0029	20′
40′	9·0648	670	691	712	734	9·0755	9·0678	699	721	743	764	9·0786	10·0029	0	0	0	1	10·0031	10′
6° 50′	9·0755	776	797	818	838	9·0859	9·0786	807	828	849	871	9·0891	10·0031	1	2	2	2	10·0032	83° 0′
7° 0′	9·0859	879	900	920	940	9·0961	9·0891	912	933	954	974	9·0995	10·0032	3	3	3	4	10·0034	82° 50′
10′	9·0961	981	001	020	040	9·1060	9·0995	015	035	056	076	9·1096	10·0034	4	5	5	5	10·0036	40′
20′	9·1060	080	099	118	138	9·1157	9·1096	116	135	155	175	9·1194	10·0036	6	6	7	7	10·0037	30′
30′	9·1157	176	195	214	233	9·1252	9·1194	214	233	252	272	9·1291	10·0037	8	8	8	9	10·0039	20′
40′	9·1252	271	289	308	326	9·1345	9·1291	310	329	348	367	9·1385	10·0039	9	0	0	0	10·0041	10′
7° 50′	9·1345	363	381	399	418	9·1436	9·1385	404	423	441	460	9·1478	10·0041	1	1	2	2	10·0042	82° 0′
8° 0′	9·1436	453	471	489	507	9·1525	9·1478	496	515	533	551	9·1569	10·0042	3	3	4	4	10·0044	81° 50′
10′	9·1525	542	560	577	594	9·1612	9·1569	587	605	622	640	9·1658	10·0044	5	5	5	6	10·0046	40′
20′	9·1612	629	646	663	680	9·1697	9·1658	675	693	710	728	9·1745	10·0046	6	7	7	8	10·0048	30′
30′	9·1697	714	731	747	764	9·1781	9·1745	762	779	797	814	9·1831	10·0048	8	9	9	9	10·0050	20′
40′	9·1781	797	814	830	847	9·1863	9·1831	848	864	881	898	9·1915	10·0050	0	1	1	1	10·0052	10′
8° 50′	9·1863	879	895	911	927	9·1943	9·1915	931	948	964	981	9·1997	10·0052	2	3	3	3	10·0054	81° 0′
9° 0′	9·1943	959	975	991	007	9·2022	9·1997	013	030	046	062	9·2078	10·0054	4	5	5	5	10·0056	80° 50′
10′	9·2022	038	054	069	085	9·2100	9·2078	094	110	126	142	9·2158	10·0056	6	7	7	7	10·0058	40′
20′	9·2100	115	131	146	161	9·2176	9·2158	174	189	205	221	9·2236	10·0058	8	9	9	0	10·0060	30′
30′	9·2176	191	206	221	236	9·2251	9·2236	252	267	282	298	9·2313	10·0060	0	1	1	2	10·0062	20′
40′	9·2251	266	280	295	310	9·2324	9·2313	328	343	359	374	9·2389	10·0062	3	3	3	4	10·0064	10′
9° 50′	9·2324	339	353	368	382	9·2397	9·2389	404	419	434	448	9·2463	10·0064	5	5	6	6	10·0066	80° 0′
10° 0′	9·2397	411	425	439	454	9·2468	9·2463	478	493	507	522	9·2536	10·0066	7	7	8	8	10·0069	79° 50′
10′	9·2468	482	496	510	524	9·2538	9·2536	551	565	580	594	9·2609	10·0069	9	0	0	1	10·0071	40′
20′	9·2538	551	565	579	593	9·2606	9·2609	623	637	651	666	9·2680	10·0071	1	2	2	3	10·0073	30′
30′	9·2606	620	634	647	661	9·2674	9·2680	694	708	722	736	9·2750	10·0073	4	4	5	5	10·0076	20′
40′	9·2674	687	701	714	727	9·2740	9·2750	764	777	791	805	9·2819	10·0076	6	7	7	8	10·0078	10′
10° 50′	9·2740	754	767	780	793	9·2806	9·2819	832	846	859	873	9·2887	10·0078	9	9	0	0	10·0081	79° 0′
11° 0′	9·2806	819	832	845	858	9·2870	9·2887	900	913	927	940	9·2953	10·0081	1	2	2	3	10·0083	78° 50′
10′	9·2870	883	896	909	921	9·2934	9·2953	967	980	993	006	9·3020	10·0083	4	4	5	5	10·0086	40′
20′	9·2934	947	959	972	984	9·2997	9·3020	033	046	059	072	9·3085	10·0086	6	7	7	8	10·0088	30′
30′	9·2997	009	021	034	046	9·3058	9·3085	098	110	123	136	9·3149	10·0088	9	9	0	0	10·0091	20′
40′	9·3058	070	083	095	107	9·3119	9·3149	162	174	187	200	9·3212	10·0091	1	2	2	3	10·0093	10′
11° 50′	9·3119	131	143	155	167	9·3179	9·3212	225	237	250	262	9·3275	10·0093	4	4	5	5	10·0096	78° 0′
12° 0′	9·3179	191	202	214	226	9·3238	9·3275	287	300	312	324	9·3336	10·0096	6	7	8	8	10·0099	77° 50′
10′	9·3238	250	261	273	284	9·3296	9·3336	349	361	373	385	9·3397	10·0099	9	0	0	1	10·0101	40′
20′	9·3296	308	319	331	342	9·3353	9·3397	409	422	434	446	9·3458	10·0101	2	3	3	4	10·0104	30′
30′	9·3353	365	376	387	399	9·3410	9·3458	469	481	493	505	9·3517	10·0104	5	5	6	6	10·0107	20′
40′	9·3410	421	432	444	455	9·3466	9·3517	529	541	552	564	9·3576	10·0107	8	8	9	9	10·0110	10′
12° 50′	9·3466	477	488	499	510	9·3521	9·3576	587	599	611	622	9·3634	10·0110	0	1	2	2	10·0113	77° 0′
13° 0′	9·3521	532	543	554	564	9·3575	9·3634	645	657	668	680	9·3691	10·0113	3	4	5	5	10·0116	76° 50′
10′	9·3575	586	597	608	618	9·3629	9·3691	702	714	725	736	9·3748	10·0116	6	7	7	8	10·0119	40′
20′	9·3629	640	650	661	671	9·3682	9·3748	759	770	781	792	9·3804	10·0119	9	0	0	1	10·0122	30′
30′	9·3682	692	703	713	724	9·3734	9·3804	815	826	837	848	9·3859	10·0122	2	3	4	4	10·0125	20′
40′	9·3734	745	755	765	775	9·3786	9·3859	870	881	892	903	9·3914	10·0125	5	6	7	7	10·0128	10′
13° 50′	9·3786	796	806	816	827	9·3837	9·3914	924	935	946	957	9·3968	10·0128	8	9	0	0	10·0131	76° 0′
14° 0′	9·3837	847	857	867	877	9·3887	9·3968	978	989	000	011	9·4021	10·0131	2	2	3	3	10·0134	75° 50′
10′	9·3887	897	907	917	927	9·3937	9·4021	032	042	053	064	9·4074	10·0134	5	5	6	7	10·0137	40′
20′	9·3937	947	957	966	976	9·3986	9·4074	085	095	106	116	9·4127	10·0137	8	9	9	0	10·0141	30′
30′	9·3986	996	006	015	025	9·4035	9·4127	137	147	158	168	9·4178	10·0141	1	2	3	3	10·0144	20′
40′	9·4035	044	054	063	073	9·4083	9·4178	189	199	209	220	9·4230	10·0144	5	5	6	7	10·0147	10′
14° 50′	9·4083	092	102	111	121	9·4130	9·4230	240	250	260	270	9·4281	10·0147	8	9	9	0	10·0151	75° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	75° to 85°
	L. COSINES.						L. COTANGENTS.						L. COSECANTS.						

5° to 15°	L. COSECANTS.						L. COTANGENTS.						L. COSINES.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
5° 0′	11·0597	568	540	511	483	11·0455	11·0580	551	523	494	466	11·0437	9·9983	3	3	3	3	9·9982	84° 50′
10′	11·0455	427	399	372	345	11·0318	11·0437	409	381	354	326	11·0299	9·9982	2	2	2	1	9·9981	40′
20′	11·0318	291	264	237	211	11·0184	11·0299	271	244	218	191	11·0164	9·9981	1	1	0	0	9·9980	30′
30′	11·0184	158	132	106	081	11·0055	11·0164	138	112	085	060	11·0034	9·9980	0	9	9	9	9·9979	20′
40′	11·0055	030	004	979	954	10·9930	11·0034	008	983	957	932	10·9907	9·9979	8	8	8	8	9·9977	10′
5° 50′	10·9930	905	880	856	832	10·9808	10·9907	882	857	833	808	10·9784	9·9977	7	7	7	6	9·9976	84° 0′
6° 0′	10·9808	784	760	736	713	10·9689	10·9784	760	735	711	688	10·9664	9·9976	6	6	5	5	9·9975	83° 50′
10′	10·9689	666	643	620	597	10·9574	10·9664	640	617	593	570	10·9547	9·9975	5	4	4	4	9·9973	40′
20′	10·9574	551	528	506	484	10·9461	10·9547	524	501	479	456	10·9433	9·9973	3	3	3	2	9·9972	30′
30′	10·9461	439	417	395	374	10·9352	10·9433	411	389	367	344	10·9322	9·9972	2	1	1	1	9·9971	20′
40′	10·9352	330	309	288	266	10·9245	10·9322	301	279	257	236	10·9214	9·9971	0	0	0	9	9·9969	10′
6° 50′	10·9245	224	203	182	162	10·9141	10·9214	193	172	151	129	10·9109	9·9969	9	8	8	8	9·9968	83° 0′
7° 0′	10·9141	121	100	080	060	10·9039	10·9109	088	067	046	026	10·9005	9·9968	7	7	7	6	9·9966	82° 50′
10′	10·9039	019	999	980	960	10·8940	10·9005	985	965	945	924	10·8904	9·9966	6	5	5	5	9·9964	40′
20′	10·8940	920	901	882	862	10·8843	10·8904	884	865	845	825	10·8806	9·9964	4	4	3	3	9·9963	30′
30′	10·8843	824	805	786	767	10·8748	10·8806	786	767	748	728	10·8709	9·9963	2	2	2	1	9·9961	20′
40′	10·8748	729	711	692	674	10·8655	10·8709	690	671	652	633	10·8615	9·9961	1	0	0	0	9·9959	10′
7° 50′	10·8655	637	619	601	582	10·8564	10·8615	596	577	559	540	10·8522	9·9959	9	9	8	8	9·9958	82° 0′
8° 0′	10·8564	547	529	511	493	10·8475	10·8522	504	485	467	449	10·8431	9·9958	7	7	6	6	9·9956	81° 50′
10′	10·8475	458	440	423	406	10·8388	10·8431	413	395	378	360	10·8342	9·9956	5	5	5	4	9·9954	40′
20′	10·8388	371	354	337	320	10·8303	10·8342	325	307	290	272	10·8255	9·9954	4	3	3	2	9·9952	30′
30′	10·8303	286	269	253	236	10·8219	10·8255	238	221	203	186	10·8169	9·9952	2	1	1	1	9·9950	20′
40′	10·8219	203	186	170	153	10·8137	10·8169	152	136	119	102	10·8085	9·9950	0	9	9	9	9·9948	10′
8° 50′	10·8137	121	105	089	073	10·8057	10·8085	069	052	036	019	10·8003	9·9948	8	7	7	7	9·9946	81° 0′
9° 0′	10·8057	041	025	009	993	10·7978	10·8003	987	970	954	938	10·7922	9·9946	6	5	5	5	9·9944	80° 50′
10′	10·7978	962	946	931	915	10·7900	10·7922	906	890	874	858	10·7842	9·9944	4	3	3	3	9·9942	40′
20′	10·7900	885	869	854	839	10·7824	10·7842	826	811	795	779	10·7764	9·9942	2	1	1	0	9·9940	30′
30′	10·7824	809	794	779	764	10·7749	10·7764	748	733	718	702	10·7687	9·9940	0	9	9	8	9·9938	20′
40′	10·7749	734	720	705	690	10·7676	10·7687	672	657	641	626	10·7611	9·9938	7	7	7	6	9·9936	10′
9° 50′	10·7676	661	647	632	618	10·7603	10·7611	596	581	566	552	10·7537	9·9936	5	5	4	4	9·9934	80° 0′
10° 0′	10·7603	589	575	561	546	10·7532	10·7537	522	507	493	478	10·7464	9·9934	3	3	2	2	9·9931	79° 50′
10′	10·7532	518	504	490	476	10·7462	10·7464	449	435	420	406	10·7391	9·9931	1	0	0	9	9·9929	40′
20′	10·7462	449	435	421	407	10·7394	10·7391	377	363	349	334	10·7320	9·9929	9	8	8	7	9·9927	30′
30′	10·7394	380	366	353	339	10·7326	10·7320	306	292	278	264	10·7250	9·9927	6	6	5	5	9·9924	20′
40′	10·7326	313	299	286	273	10·7260	10·7250	236	223	209	195	10·7181	9·9924	4	3	3	2	9·9922	10′
10° 50′	10·7260	246	233	220	207	10·7194	10·7181	168	154	141	127	10·7113	9·9922	1	1	0	0	9·9919	79° 0′
11° 0′	10·7194	181	168	155	142	10·7130	10·7113	100	087	073	060	10·7047	9·9919	9	8	8	7	9·9917	78° 50′
10′	10·7130	117	104	091	079	10·7066	10·7047	033	020	007	994	10·6980	9·9917	6	6	5	5	9·9914	40′
20′	10·7066	053	041	028	016	10·7003	10·6980	967	954	941	928	10·6915	9·9914	4	3	3	2	9·9912	30′
30′	10·7003	991	979	966	954	10·6942	10·6915	902	890	877	864	10·6851	9·9912	1	1	0	0	9·9909	20′
40′	10·6942	930	917	905	893	10·6881	10·6851	838	826	813	800	10·6788	9·9909	9	8	8	7	9·9907	10′
11° 50′	10·6881	869	857	845	833	10·6821	10·6788	775	763	750	738	10·6725	9·9907	6	6	5	5	9·9904	78° 0′
12° 0′	10·6821	809	798	786	774	10·6762	10·6725	713	700	688	676	10·6664	9·9904	4	3	2	2	9·9901	77° 50′
10′	10·6762	750	739	727	716	10·6704	10·6664	651	639	627	615	10·6603	9·9901	1	0	0	9	9·9899	40′
20′	10·6704	692	681	669	658	10·6647	10·6603	591	578	566	554	10·6542	9·9899	8	7	7	6	9·9896	30′
30′	10·6647	635	624	613	601	10·6590	10·6542	531	519	507	495	10·6483	9·9896	5	5	4	4	9·9893	20′
40′	10·6590	579	568	556	545	10·6534	10·6483	471	459	448	436	10·6424	9·9893	2	2	1	1	9·9890	10′
12° 50′	10·6534	523	512	501	490	10·6479	10·6424	413	401	389	378	10·6366	9·9890	0	9	8	8	9·9887	77° 0′
13° 0′	10·6479	468	457	446	436	10·6425	10·6366	355	343	332	320	10·6309	9·9887	7	6	5	5	9·9884	76° 50′
10′	10·6425	414	403	392	382	10·6371	10·6309	298	286	275	264	10·6252	9·9884	4	3	3	2	9·9881	40′
20′	10·6371	360	350	339	329	10·6318	10·6252	241	230	219	208	10·6196	9·9881	1	0	0	9	9·9878	30′
30′	10·6318	308	297	287	276	10·6266	10·6196	185	174	163	152	10·6141	9·9878	8	7	6	6	9·9875	20′
40′	10·6266	255	245	235	225	10·6214	10·6141	130	119	108	097	10·6086	9·9875	5	4	3	3	9·9872	10′
13° 50′	10·6214	204	194	184	173	10·6163	10·6086	076	065	054	043	10·6032	9·9872	2	1	0	0	9·9869	76° 0′
14° 0′	10·6163	153	143	133	123	10·6113	10·6032	022	011	000	989	10·5979	9·9869	8	8	7	7	9·9866	75° 50′
10′	10·6113	103	093	083	073	10·6063	10·5979	968	958	947	936	10·5926	9·9866	5	5	4	3	9·9863	40′
20′	10·6063	053	043	034	024	10·6014	10·5926	915	905	894	884	10·5873	9·9863	2	1	1	0	9·9859	30′
30′	10·6014	004	995	985	975	10·5965	10·5873	863	853	842	832	10·5822	9·9859	9	8	7	7	9·9856	20′
40′	10·5965	956	946	937	927	10·5917	10·5822	811	801	791	780	10·5770	9·9856	5	5	4	3	9·9853	10′
14° 50′	10·5917	908	898	889	879	10·5870	10·5770	760	750	740	730	10·5719	9·9853	2	1	1	0	9·9849	75° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′		75° to 85°
	L. SECANTS.						L. TANGENTS.						L. SINES.						

LOGARITHMIC SECANTS, TANGENTS, AND SINES.

15° to 25°	L. SINES.						L. TANGENTS.						L. SECANTS.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
15° 0′	9·4130	139	149	158	168	9·4177	9·4281	291	301	311	321	9·4331	10·0151	1	2	3	3	10·0154	74° 50′
10′	9·4177	186	195	205	214	9·4223	9·4331	341	351	361	371	9·4381	10·0154	5	5	6	7	10·0157	40′
20′	9·4223	232	242	251	260	9·4269	9·4381	390	400	410	420	9·4430	10·0157	8	9	9	0	10·0161	30′
30′	9·4269	278	287	296	305	9·4314	9·4430	440	449	459	469	9·4479	10·0161	2	2	3	4	10·0164	20′
40′	9·4314	323	332	341	350	9·4359	9·4479	488	498	508	517	9·4527	10·0164	5	6	7	7	10·0168	10′
15° 50′	9·4359	368	377	386	395	9·4403	9·4527	537	546	556	565	9·4575	10·0168	9	9	0	1	10·0172	74° 0′
16° 0′	9·4403	412	421	430	438	9·4447	9·4575	584	594	603	613	9·4622	10·0172	2	3	4	4	10·0175	73° 50′
10′	9·4447	456	465	473	482	9·4491	9·4622	632	641	651	660	9·4669	10·0175	6	7	7	8	10·0179	40′
20′	9·4491	499	508	516	525	9·4533	9·4669	679	688	697	707	9·4716	10·0179	0	0	1	2	10·0183	30′
30′	9·4533	542	550	559	567	9·4576	9·4716	725	735	744	753	9·4762	10·0183	3	4	5	6	10·0186	20′
40′	9·4576	584	593	601	609	9·4618	9·4762	771	781	790	799	9·4808	10·0186	7	8	9	9	10·0190	10′
16° 50′	9·4618	626	634	643	651	9·4659	9·4808	817	826	835	844	9·4853	10·0190	1	2	2	3	10·0194	73° 0′
17° 0′	9·4659	668	676	684	692	9·4700	9·4853	862	871	880	889	9·4898	10·0194	5	6	6	7	10·0198	72° 50′
10′	9·4700	709	717	725	733	9·4741	9·4898	907	916	925	934	9·4943	10·0198	9	9	0	1	10·0202	40′
20′	9·4741	749	757	765	773	9·4781	9·4943	952	961	970	978	9·4987	10·0202	3	3	4	5	10·0206	30′
30′	9·4781	789	797	805	813	9·4821	9·4987	996	005	014	022	9·5031	10·0206	7	7	8	9	10·0210	20′
40′	9·4821	829	837	845	853	9·4861	9·5031	040	049	057	066	9·5075	10·0210	1	1	2	3	10·0214	10′
17° 50′	9·4861	869	876	884	892	9·4900	9·5075	083	092	101	109	9·5118	10·0214	5	5	6	7	10·0218	72° 0′
18° 0′	9·4900	908	915	923	931	9·4939	9·5118	126	135	143	152	9·5161	10·0218	9	0	0	1	10·0222	71° 50′
10′	9·4939	946	954	962	969	9·4977	9·5161	169	178	186	195	9·5203	10·0222	3	4	5	5	10·0226	40′
20′	9·4977	984	992	000	007	9·5015	9·5203	212	220	228	237	9·5245	10·0226	7	8	9	0	10·0230	30′
30′	9·5015	022	030	037	045	9·5052	9·5245	254	262	270	279	9·5287	10·0230	1	2	3	4	10·0235	20′
40′	9·5052	060	067	075	082	9·5090	9·5287	295	304	312	320	9·5329	10·0235	6	6	7	8	10·0239	10′
18° 50′	9·5090	097	104	112	119	9·5126	9·5329	337	345	353	362	9·5370	10·0239	0	1	2	2	10·0243	71° 0′
19° 0′	9·5126	134	141	148	156	9·5163	9·5370	378	386	394	402	9·5411	10·0243	4	5	6	7	10·0248	70° 50′
10′	9·5163	170	177	185	192	9·5199	9·5411	419	427	435	443	9·5451	10·0248	9	9	0	1	10·0252	40′
20′	9·5199	206	213	221	228	9·5235	9·5451	459	467	475	483	9·5491	10·0252	3	4	5	6	10·0257	30′
30′	9·5235	242	249	256	263	9·5270	9·5491	500	508	516	524	9·5531	10·0257	7	8	9	0	10·0261	20′
40′	9·5270	278	285	292	299	9·5306	9·5531	539	547	555	563	9·5571	10·0261	2	3	4	5	10·0266	10′
19° 50′	9·5306	313	320	327	334	9·5341	9·5571	579	587	595	603	9·5611	10·0266	6	7	8	9	10·0270	70° 0′
20° 0′	9·5341	347	354	361	368	9·5375	9·5611	619	626	634	642	9·5650	10·0270	1	2	3	4	10·0275	69° 50′
10′	9·5375	382	389	396	402	9·5409	9·5650	658	665	673	681	9·5689	10·0275	6	7	8	8	10·0279	40′
20′	9·5409	416	423	430	436	9·5443	9·5689	696	704	712	720	9·5727	10·0279	0	1	2	3	10·0284	30′
30′	9·5443	450	457	463	470	9·5477	9·5727	735	743	750	758	9·5766	10·0284	5	6	7	8	10·0289	20′
40′	9·5477	484	490	497	504	9·5510	9·5766	773	781	789	796	9·5804	10·0289	0	1	2	3	10·0294	10′
20° 50′	9·5510	517	523	530	537	9·5543	9·5804	811	819	827	834	9·5842	10·0294	5	6	7	8	10·0298	69° 0′
21° 0′	9·5543	550	556	563	570	9·5576	9·5842	849	857	864	872	9·5879	10·0298	9	0	1	2	10·0303	68° 50′
10′	9·5576	583	589	596	602	9·5609	9·5879	887	894	902	909	9·5917	10·0303	4	5	6	7	10·0308	40′
20′	9·5609	615	621	628	634	9·5641	9·5917	924	932	939	947	9·5954	10·0308	9	0	1	2	10·0313	30′
30′	9·5641	647	654	660	666	9·5673	9·5954	961	969	976	984	9·5991	10·0313	4	5	6	7	10·0318	20′
40′	9·5673	679	685	692	698	9·5704	9·5991	998	006	013	020	9·6028	10·0318	9	0	1	2	10·0323	10′
21° 50′	9·5704	711	717	723	729	9·5736	9·6028	035	042	050	057	9·6064	10·0323	4	5	6	7	10·0328	68° 0′
22° 0′	9·5736	742	748	754	761	9·5767	9·6064	071	079	086	093	9·6100	10·0328	9	0	1	2	10·0333	67° 50′
10′	9·5767	773	779	785	792	9·5798	9·6100	108	115	122	129	9·6136	10·0333	4	6	7	8	10·0339	40′
20′	9·5798	804	810	816	822	9·5828	9·6136	144	151	158	165	9·6172	10·0339	0	1	2	3	10·0344	30′
30′	9·5828	834	841	847	853	9·5859	9·6172	179	187	194	201	9·6208	10·0344	5	6	7	8	10·0349	20′
40′	9·5859	865	871	877	883	9·5889	9·6208	215	222	229	236	9·6243	10·0349	0	1	2	3	10·0354	10′
22° 50′	9·5889	895	901	907	913	9·5919	9·6243	250	257	264	271	9·6279	10·0354	5	7	8	9	10·0360	67° 0′
23° 0′	9·5919	925	931	937	943	9·5948	9·6279	286	293	300	307	9·6314	10·0360	1	2	3	4	10·0365	66° 50′
10′	9·5948	954	960	966	972	9·5978	9·6314	321	328	334	341	9·6348	10·0365	6	7	8	9	10·0371	40′
20′	9·5978	984	990	995	001	9·6007	9·6348	355	362	369	376	9·6383	10·0371	2	3	4	5	0·0376	30′
30′	9·6007	013	019	024	030	9·6036	9·6383	390	397	404	411	9·6417	10·0376	7	8	9	0	10·0382	20′
40′	9·6036	042	047	053	059	9·6065	9·6417	424	431	438	445	9·6452	10·0382	3	4	5	6	10·0387	10′
23° 50′	9·6065	070	076	082	087	9·6093	9·6452	459	465	472	479	9·6486	10·0387	8	9	0	2	10·0393	66° 0′
24° 0′	9·6093	099	104	110	116	9·6121	9·6486	493	499	506	513	9·6520	10·0393	4	5	6	7	10·0398	65° 50′
10′	9·6121	127	133	138	144	9·6149	9·6520	527	533	540	547	9·6553	10·0398	9	1	2	3	10·0404	40′
20′	9·6149	155	161	166	172	9·6177	9·6553	560	567	574	580	9·6587	10·0404	5	6	7	9	10·0410	30′
30′	9·6177	183	188	194	199	9·6205	9·6587	594	600	607	614	9·6620	10·0410	1	2	3	4	10·0416	20′
40′	9·6205	210	216	221	227	9·6232	9·6620	627	634	640	647	9·6654	10·0416	7	8	9	0	10·0421	10′
24° 50′	9·6232	238	243	249	254	9·6259	9·6654	660	667	674	680	9·6687	10·0421	3	4	5	6	10·0427	65° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	65° to 75°
	L. COSINES.						L. COTANGENTS.						L. COSECANTS.						

LOGARITHMIC COSINES, COTANGENTS, AND COSECANTS.

15° to 25°	L. COSECANTS.						L. COTANGENTS.						L. COSINES.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
15° 0′	10·5870	861	851	842	832	10·5823	10·5719	709	699	689	679	10·5669	9·9849	9	8	7	7	9·9846	74° 50′
10′	10·5823	814	805	795	786	10·5777	10·5669	659	649	639	629	10·5619	9·9846	5	5	4	3	9·9843	40′
20′	10·5777	768	758	749	740	10·5731	10·5619	610	600	590	580	10·5570	9·9843	2	1	1	0	9·9839	30′
30′	10·5731	722	713	704	695	10·5686	10·5570	560	551	541	531	10·5521	9·9839	8	8	7	6	9·9836	20′
40′	10·5686	677	668	659	650	10·5641	10·5521	512	502	492	483	10·5473	9·9836	5	4	3	3	9·9832	10′
15° 50′	10·5641	632	623	614	605	10·5597	10·5473	463	454	444	435	10·5425	9·9832	1	1	0	9	9·9828	74° 0′
16° 0′	10·5597	588	579	570	562	10·5553	10·5425	416	406	397	387	10·5378	9·9828	8	7	6	6	9·9825	73° 50′
10′	10·5553	544	535	527	518	10·5509	10·5378	368	359	349	340	10·5331	9·9825	4	3	3	2	9·9821	40′
20′	10·5509	501	492	484	475	10·5467	10·5331	321	312	303	293	10·5284	9·9821	0	0	9	8	9·9817	30′
30′	10·5467	458	450	441	433	10·5424	10·5284	275	265	256	247	10·5238	9·9817	7	6	5	4	9·9814	20′
40′	10·5424	416	407	399	391	10·5382	10·5238	229	219	210	201	10·5192	9·9814	3	2	1	1	9·9810	10′
16° 50′	10·5382	374	366	357	349	10·5341	10·5192	183	174	165	156	10·5147	9·9810	9	8	8	7	9·9806	73° 0′
17° 0′	10·5341	332	324	316	308	10·5300	10·5147	138	129	120	111	10·5102	9·9806	5	4	4	3	9·9802	72° 50′
10′	10·5300	291	283	275	267	10·5259	10·5102	093	084	075	066	10·5057	9·9802	1	1	0	0	9·9798	40′
20′	10·5259	251	243	235	227	10·5219	10·5057	048	039	030	022	10·5013	9·9798	7	7	6	5	9·9794	30′
30′	10·5219	211	203	195	187	10·5179	10·5013	004	995	986	978	10·4969	9·9794	3	3	2	1	9·9790	20′
40′	10·5179	171	163	155	147	10·5139	10·4969	960	951	943	934	10·4925	9·9790	0	9	8	7	9·9786	10′
17° 50′	10·5139	131	124	116	108	10·5100	10·4925	917	908	899	891	10·4882	9·9786	5	5	4	3	9·9782	72° 0′
18° 0′	10·5100	092	085	077	069	10·5061	10·4882	874	865	857	848	10·4839	9·9782	1	0	0	9	9·9778	71° 50′
10′	10·5061	054	046	038	031	10·5023	10·4839	831	822	814	805	10·4797	9·9778	7	6	5	5	9·9774	40′
20′	10·5023	016	008	000	993	10·4985	10·4797	788	780	772	763	10·4755	9·9774	3	2	1	0	9·9770	30′
30′	10·4985	978	970	963	955	10·4948	10·4755	746	738	730	721	10·4713	9·9770	9	8	7	6	9·9765	20′
40′	10·4948	940	933	925	918	10·4910	10·4713	705	696	688	680	10·4671	9·9765	4	4	3	2	9·9761	10′
18° 50′	10·4910	903	896	888	881	10·4874	10·4671	663	655	647	638	10·4630	9·9761	0	9	8	8	9·9757	71° 0′
19° 0′	10·4874	866	859	852	844	10·4837	10·4630	622	614	606	598	10·4589	9·9757	6	5	4	3	9·9752	70° 50′
10′	10·4837	830	823	815	808	10·4801	10·4589	581	573	565	557	10·4549	9·9752	1	1	0	9	9·9748	40′
20′	10·4801	794	787	779	772	10·4765	10·4549	541	533	525	517	10·4509	9·9748	7	6	5	4	9·9743	30′
30′	10·4765	758	751	744	737	10·4730	10·4509	500	492	484	476	10·4469	9·9743	3	2	1	0	9·9739	20′
40′	10·4730	722	715	708	701	10·4694	10·4469	461	453	445	437	10·4429	9·9739	8	7	6	5	9·9734	10′
19° 50′	10·4694	687	680	673	666	10·4659	10·4429	421	413	405	397	10·4389	9·9734	4	3	2	1	9·9730	70° 0′
20° 0′	10·4659	653	646	639	632	10·4625	10·4389	381	374	366	358	10·4350	9·9730	5	5	7	6	9·9725	69° 50′
10′	10·4625	618	611	604	598	10·4591	10·4350	342	335	327	319	10·4311	9·9725	4	3	2	2	9·9721	40′
20′	10·4591	584	577	570	564	10·4557	10·4311	304	296	288	280	10·4273	9·9721	0	9	8	7	9·9716	30′
30′	10·4557	550	543	537	530	10·4523	10·4273	265	257	250	242	10·4234	9·9716	5	4	3	2	9·9711	20′
40′	10·4523	516	510	503	496	10·4490	10·4234	227	219	211	204	10·4196	9·9711	0	9	8	7	9·9706	10′
20° 50′	10·4490	483	477	470	463	10·4457	10·4196	189	181	173	166	10·4158	9·9706	5	4	3	2	9·9702	69° 0′
21° 0′	10·4457	450	444	437	430	10·4424	10·4158	151	143	136	128	10·4121	9·9702	1	0	9	8	9·9697	68° 50′
10′	10·4424	417	411	404	398	10·4391	10·4121	113	106	098	091	10·4083	9·9697	6	5	4	3	9·9692	40′
20′	10·4391	385	379	372	366	10·4359	10·4083	076	068	061	053	10·4046	9·9692	1	0	9	8	9·9687	30′
30′	10·4359	353	346	340	334	10·4327	10·4046	039	031	024	016	10·4009	9·9687	6	5	4	3	9·9682	20′
40′	10·4327	321	315	308	302	10·4296	10·4009	002	994	987	980	10·3972	9·9682	1	0	9	8	9·9677	10′
21° 50′	10·4296	289	283	277	271	10·4264	10·3972	965	958	950	943	10·3936	9·9677	6	5	4	3	9·9672	68° 0′
22° 0′	10·4264	258	252	246	239	10·4233	10·3936	929	921	914	907	10·3900	9·9672	1	0	9	8	9·9667	67° 50′
10′	10·4233	227	221	215	208	10·4202	10·3900	892	885	878	871	10·3864	9·9667	6	4	3	2	9·9661	40′
20′	10·4202	196	190	184	178	10·4172	10·3864	856	849	842	835	10·3828	9·9661	0	5	8	7	9·9656	30′
30′	10·4172	166	159	153	147	10·4141	10·3828	821	813	806	799	10·3792	9·9656	5	4	3	2	9·9651	20′
40′	10·4141	135	129	123	117	10·4111	10·3792	785	778	771	764	10·3757	9·9651	0	9	8	7	9·9646	10′
22° 50′	10·4111	105	099	093	087	10·4081	10·3757	750	743	736	729	10·3721	9·9646	5	3	2	1	9·9640	67° 0′
23° 0′	10·4081	075	069	063	057	10·4052	10·3721	714	707	700	693	10·3686	9·9640	5	8	7	6	9·9635	66° 50′
10′	10·4052	046	040	034	028	10·4022	10·3686	679	672	666	659	10·3652	9·9635	4	3	2	1	9·9630	40′
20′	10·4022	016	010	005	999	10·3993	10·3652	645	638	631	624	10·3617	9·9630	8	7	6	5	9·9624	30′
30′	10·3993	987	981	976	970	10·3964	10·3617	610	603	596	589	10·3583	9·9624	3	2	1	0	9·9618	20′
40′	10·3964	958	953	947	941	10·3935	10·3583	576	569	562	555	10·3548	9·9618	7	6	5	4	9·9613	10′
23° 50′	10·3935	930	924	918	913	10·3907	10·3548	541	535	528	521	10·3514	9·9613	2	1	0	8	9·9607	66° 0′
24° 0′	10·3907	901	896	890	884	10·3879	10·3514	507	501	494	487	10·3480	9·9607	6	5	4	3	9·9602	65° 50′
10′	10·3879	873	867	862	856	10·3851	10·3480	473	467	460	453	10·3447	9·9602	1	9	8	7	9·9596	40′
20′	10·3851	845	839	834	828	10·3823	10·3447	440	433	426	420	10·3413	9·9596	5	4	3	1	9·9590	30′
30′	10·3823	817	812	806	801	10·3795	10·3413	406	400	393	386	10·3380	9·9590	9	8	7	6	9·9584	20′
40′	10·3795	790	784	779	773	10·3768	10·3380	373	366	360	353	10·3346	9·9584	3	2	1	0	9·9579	10′
24° 50′	10·3768	762	757	751	746	10·3741	10·3346	340	333	326	320	10·3313	9·9579	7	6	5	4	9·9573	65° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	
65° to 75°	L. SECANTS.						L. TANGENTS.						L. SINES.						65° to 75°

LOGARITHMIC SECANTS, TANGENTS, AND SINES.

25° to 35°	L. SINES.						L. TANGENTS.						L. SECANTS.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
25° 0′	9·6259	65	70	76	81	9·6286	9·6687	93	00	06	13	9·6750	10·0427	28	30	31	32	10·0433	64° 50′
10′	9·6286	92	97	03	08	9·6313	9·6720	26	33	39	46	9·6752	10·0433	34	36	37	38	10·0439	40′
20′	9·6313	19	24	29	35	9·6340	9·6752	59	65	72	78	9·6785	10·0439	40	42	43	44	10·0445	30′
30′	9·6340	45	50	56	61	9·6366	9·6785	91	98	04	11	9·6817	10·0445	46	48	49	50	10·0451	20′
40′	9·6366	71	77	82	87	9·6392	9·6817	24	30	37	43	9·6850	10·0451	52	54	55	56	10·0457	10′
25° 50′	9·6392	98	03	08	13	9·6418	9·6850	56	63	69	75	9·6882	10·0457	58	60	61	62	10·0463	64° 0′
26° 0′	9·6418	24	29	34	39	9·6444	9·6882	88	95	01	07	9·6914	10·0463	65	66	67	68	10·0470	63° 50′
10′	9·6444	49	54	60	65	9·6470	9·6914	20	27	33	39	9·6946	10·0470	71	72	73	75	10·0476	40′
20′	9·6470	75	80	85	90	9·6495	9·6946	52	58	65	71	9·6977	10·0476	77	78	80	81	10·0482	30′
30′	9·6495	00	05	10	15	9·6521	9·6977	84	90	96	03	9·7009	10·0482	83	85	86	87	10·0488	20′
40′	9·6521	26	31	36	41	9·6546	9·7009	15	22	28	34	9·7040	10·0488	90	91	92	94	10·0495	10′
26° 50′	9·6546	51	56	61	66	9·6570	9·7040	47	53	59	65	9·7072	10·0495	96	97	99	00	10·0501	63° 0′
27° 0′	9·6570	75	80	85	90	9·6595	9·7072	78	84	90	97	9·7103	10·0501	02	04	05	06	10·0508	62° 50′
10′	9·6595	00	05	10	15	9·6620	9·7103	09	15	21	28	9·7134	10·0508	09	10	12	13	10·0514	40′
20′	9·6620	25	29	34	39	9·6644	9·7134	40	46	52	59	9·7165	10·0514	15	17	18	19	10·0521	30′
30′	9·6644	49	54	59	63	9·6668	9·7165	71	77	83	89	9·7196	10·0521	22	23	25	26	10·0527	20′
40′	9·6668	73	78	83	87	9·6692	9·7196	02	08	14	20	9·7226	10·0527	29	30	31	33	10·0534	10′
27° 50′	9·6692	97	02	07	11	9·6716	9·7226	32	38	45	51	9·7257	10·0534	35	37	38	39	10·0541	62° 0′
28° 0′	9·6716	21	26	30	35	9·6740	9·7257	63	69	75	81	9·7287	10·0541	42	43	45	46	10·0547	61° 50′
10′	9·6740	44	49	54	59	9·6763	9·7287	93	99	05	11	9·7317	10·0547	49	50	51	53	10·0554	40′
20′	9·6763	68	73	77	82	9·6787	9·7317	24	30	36	42	9·7348	10·0554	56	57	58	60	10·0561	30′
30′	9·6787	91	96	01	05	9·6810	9·7348	54	60	66	72	9·7378	10·0561	62	64	65	67	10·0568	20′
40′	9·6810	14	19	24	28	9·6833	9·7378	84	90	96	02	9·7408	10·0568	69	71	72	73	10·0575	10′
28° 50′	9·6833	37	42	47	51	9·6856	9·7408	14	20	26	32	9·7438	10·0575	76	78	79	80	10·0582	61° 0′
29° 0′	9·6856	60	65	69	74	9·6878	9·7438	43	49	55	61	9·7467	10·0582	83	85	86	87	10·0589	60° 50′
10′	9·6878	83	87	92	96	9·6901	9·7467	73	79	85	91	9·7497	10·0589	90	92	93	94	10·0596	40′
20′	9·6901	05	10	14	19	9·6923	9·7497	03	09	15	21	9·7526	10·0596	97	99	00	02	10·0603	30′
30′	9·6923	28	32	37	41	9·6946	9·7526	32	38	44	50	9·7556	10·0603	04	06	07	09	10·0610	20′
40′	9·6946	50	55	59	63	9·6968	9·7556	62	68	73	79	9·7585	10·0610	12	13	15	16	10·0617	10′
29° 50′	9·6968	72	77	81	85	9·6990	9·7585	91	97	03	09	9·7614	10·0617	19	20	22	23	10·0625	60° 0′
30° 0′	9·6990	94	98	03	07	9·7012	9·7614	20	26	32	38	9·7644	10·0625	26	28	29	31	10·0632	59° 50′
10′	9·7012	16	20	25	29	9·7033	9·7644	49	55	61	67	9·7673	10·0632	33	35	36	38	10·0639	40′
20′	9·7033	37	42	46	50	9·7055	9·7673	78	84	90	96	9·7701	10·0639	41	42	44	45	10·0647	30′
30′	9·7055	59	63	68	72	9·7076	9·7701	07	13	19	25	9·7730	10·0647	48	50	51	53	10·0654	20′
40′	9·7076	80	85	89	93	9·7097	9·7730	36	42	48	53	9·7759	10·0654	56	57	59	60	10·0662	10′
30° 50′	9·7097	02	06	10	14	9·7118	9·7759	65	71	76	82	9·7788	10·0662	63	65	66	68	10·0669	59° 0′
31° 0′	9·7118	23	27	31	35	9·7139	9·7788	93	99	05	11	9·7816	10·0669	71	72	74	75	10·0677	58° 50′
10′	9·7139	44	48	52	56	9·7160	9·7816	22	28	33	39	9·7845	10·0677	78	80	82	83	10·0685	40′
20′	9·7160	64	68	73	77	9·7181	9·7845	50	56	62	68	9·7873	10·0685	86	88	89	91	10·0692	30′
30′	9·7181	85	89	93	97	9·7201	9·7873	79	85	90	96	9·7902	10·0692	94	95	97	99	10·0700	20′
40′	9·7201	05	10	14	18	9·7222	9·7902	07	13	18	24	9·7930	10·0700	02	03	05	06	10·0708	10′
31° 50′	9·7222	26	30	34	38	9·7242	9·7930	35	41	47	52	9·7958	10·0708	09	11	13	14	10·0716	58° 0′
32° 0′	9·7242	46	50	54	58	9·7262	9·7958	64	69	75	80	9·7986	10·0716	17	19	21	22	10·0724	57° 50′
10′	9·7262	66	70	74	78	9·7282	9·7986	92	97	03	08	9·8014	10·0724	25	27	28	30	10·0732	40′
20′	9·7282	86	90	94	98	9·7302	9·8014	20	25	31	36	9·8042	10·0732	33	35	36	38	10·0740	30′
30′	9·7302	06	10	14	18	9·7322	9·8042	47	53	59	64	9·8070	10·0740	41	43	45	46	10·0748	20′
40′	9·7322	26	30	34	38	9·7342	9·8070	75	81	86	92	9·8097	10·0748	49	51	53	54	10·0756	10′
32° 50′	9·7342	45	49	53	57	9·7361	9·8097	03	09	14	20	9·8125	10·0756	58	59	61	62	10·0764	57° 0′
33° 0′	9·7361	65	69	73	77	9·7380	9·8125	31	36	42	47	9·8153	10·0764	66	67	69	71	10·0772	56° 50′
10′	9·7380	84	88	92	96	9·7400	9·8153	58	64	69	75	9·8180	10·0772	74	76	77	79	10·0781	40′
20′	9·7400	04	07	11	15	9·7419	9·8180	86	91	97	02	9·8208	10·0781	82	84	86	87	10·0789	30′
30′	9·7419	23	27	30	34	9·7438	9·8208	13	19	24	30	9·8235	10·0789	91	92	94	96	10·0797	20′
40′	9·7438	42	45	49	53	9·7457	9·8235	41	46	52	57	9·8263	10·0797	99	01	02	04	10·0806	10′
33° 50′	9·7457	61	64	68	72	9·7476	9·8263	68	74	79	84	9·8290	10·0806	07	09	11	13	10·0814	56° 0′
34° 0′	9·7476	79	83	87	91	9·7494	9·8290	95	01	06	12	9·8317	10·0814	16	18	19	21	10·0823	55° 50′
10′	9·7494	98	02	05	09	9·7513	9·8317	23	28	33	39	9·8344	10·0823	25	26	28	30	10·0831	40′
20′	9·7513	17	20	24	28	9·7531	9·8344	50	55	61	66	9·8371	10·0831	33	35	37	38	10·0840	30′
30′	9·7531	35	39	42	46	9·7550	9·8371	77	82	88	93	9·8398	10·0840	42	44	45	47	10·0849	20′
40′	9·7550	53	57	61	64	9·7568	9·8398	04	09	15	20	9·8425	10·0849	51	52	54	56	10·0858	10′
34° 50′	9·7568	71	75	79	82	9·7586	9·8425	31	36	42	47	9·8452	10·0858	59	61	63	65	10·0866	55° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	55° to 65°
	L. COSINES.						L. COTANGENTS.						L. COSECANTS.						

25° to 35°	L. COSECANTS.						L. COTANGENTS.						L. COSINES.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
25° 0′	10·3741	35	30	24	19	10·3714	10·3313	07	00	94	87	10·3286	9·9573	72	70	69	68	9·9567	64° 50′
10′	10·3714	08	03	97	92	10·3687	10·3280	74	67	61	54	10·3248	9·9567	66	64	63	62	9·9561	40′
20′	10·3687	81	76	71	65	10·3660	10·3248	41	35	28	22	10·3215	9·9561	60	58	57	56	9·9555	30′
30′	10·3660	55	50	44	39	10·3634	10·3215	09	02	96	89	10·3183	9·9555	54	52	51	50	9·9549	20′
40′	10·3634	29	23	18	13	10·3608	10·3183	76	70	63	57	10·3150	9·9549	48	46	45	44	9·9543	10′
25° 50′	10·3608	02	97	92	87	10·3582	10·3150	44	37	31	25	10·3118	9·9543	42	40	39	38	9·9537	64° 0′
26° 0′	10·3582	76	71	66	61	10·3556	10·3118	12	05	99	93	10·3086	9·9537	35	34	33	32	9·9530	63° 50′
10′	10·3556	51	46	40	35	10·3530	10·3086	80	73	67	61	10·3054	9·9530	29	28	27	25	9·9524	40′
20′	10·3530	25	20	15	10	10·3505	10·3054	48	42	35	29	10·3023	9·9524	23	22	20	19	9·9518	30′
30′	10·3505	00	95	90	85	10·3479	10·3023	16	10	04	97	10·2991	9·9518	17	15	14	13	9·9512	20′
40′	10·3479	74	69	64	59	10·3454	10·2991	85	78	72	66	10·2960	9·9512	10	09	08	07	9·9505	10′
26° 50′	10·3454	49	44	39	34	10·3430	10·2960	53	47	41	35	10·2928	9·9505	04	03	01	00	9·9499	63° 0′
27° 0′	10·3430	25	20	15	10	10·3405	10·2928	22	16	10	03	10·2897	9·9499	98	96	95	94	9·9492	62° 50′
10′	10·3405	00	95	90	85	10·3380	10·2897	91	85	79	72	10·2866	9·9492	91	90	88	87	9·9486	40′
20′	10·3380	75	71	66	61	10·3356	10·2866	60	54	48	41	10·2835	9·9486	85	83	82	81	9·9479	30′
30′	10·3356	51	46	41	37	10·3332	10·2835	29	23	17	11	10·2804	9·9479	78	77	75	74	9·9473	20′
40′	10·3332	27	22	17	13	10·3308	10·2804	98	92	86	80	10·2774	9·9473	71	70	69	67	9·9466	10′
27° 50′	10·3308	03	98	93	89	10·3284	10·2774	68	62	55	49	10·2743	9·9466	65	63	62	61	9·9459	62° 0′
28° 0′	10·3284	79	74	70	65	10·3260	10·2743	37	31	25	19	10·2713	9·9459	58	57	55	54	9·9453	61° 50′
10′	10·3260	56	51	46	41	10·3237	10·2713	07	01	95	89	10·2683	9·9453	51	50	49	47	9·9446	40′
20′	10·3237	32	27	23	18	10·3213	10·2683	76	70	64	58	10·2652	9·9446	44	43	42	40	9·9439	30′
30′	10·3213	09	04	99	95	10·3190	10·2652	46	40	34	28	10·2622	9·9439	38	36	35	33	9·9432	20′
40′	10·3190	86	81	76	72	10·3167	10·2622	16	10	04	98	10·2592	9·9432	31	29	28	27	9·9425	10′
28° 50′	10·3167	63	58	53	49	10·3144	10·2592	86	80	74	68	10·2562	9·9425	24	22	21	20	9·9418	61° 0′
29° 0′	10·3144	40	35	31	26	10·3122	10·2562	57	51	45	39	10·2533	9·9418	17	15	14	13	9·9411	60° 50′
10′	10·3122	17	13	08	04	10·3099	10·2533	27	21	15	09	10·2503	9·9411	10	08	07	06	9·9404	40′
20′	10·3099	95	90	86	81	10·3077	10·2503	97	91	85	79	10·2474	9·9404	03	01	00	98	9·9397	30′
30′	10·3077	72	68	63	59	10·3054	10·2474	68	62	56	50	10·2444	9·9397	96	94	93	91	9·9390	20′
40′	10·3054	50	45	41	37	10·3032	10·2444	38	32	27	21	10·2415	9·9390	88	87	85	84	9·9383	10′
29° 50′	10·3032	28	23	19	15	10·3010	10·2415	09	03	97	91	10·2386	9·9383	81	80	78	77	9·9375	60° 0′
30° 0′	10·3010	06	02	97	93	10·2988	10·2386	80	74	68	62	10·2356	9·9375	74	72	71	69	9·9368	59° 50′
10′	10·2988	84	80	75	71	10·2967	10·2356	51	45	39	33	10·2327	9·9368	67	65	64	62	9·9361	40′
20′	10·2967	63	58	54	50	10·2945	10·2327	22	16	10	04	10·2299	9·9361	59	58	56	55	9·9353	30′
30′	10·2945	41	37	32	28	10·2924	10·2299	93	87	81	75	10·2270	9·9353	52	50	49	47	9·9346	20′
40′	10·2924	20	15	11	07	10·2903	10·2270	64	58	52	47	10·2241	9·9346	44	43	41	40	9·9338	10′
30° 50′	10·2903	98	94	90	86	10·2882	10·2241	35	29	24	18	10·2212	9·9338	37	35	34	32	9·9331	59° 0′
31° 0′	10·2882	77	73	69	65	10·2861	10·2212	07	01	95	89	10·2184	9·9331	29	28	26	25	9·9323	58° 50′
10′	10·2861	56	52	48	44	10·2840	10·2184	78	72	67	61	10·2155	9·9323	22	20	18	17	9·9315	40′
20′	10·2840	36	32	27	23	10·2819	10·2155	50	44	38	32	10·2127	9·9315	14	12	11	09	9·9308	30′
30′	10·2819	15	11	07	03	10·2799	10·2127	21	15	10	04	10·2098	9·9308	06	05	03	01	9·9300	20′
40′	10·2799	95	90	86	82	10·2778	10·2098	93	87	82	76	10·2070	9·9300	98	97	95	94	9·9292	10′
31° 50′	10·2778	74	70	66	62	10·2758	10·2070	65	59	53	48	10·2042	9·9292	91	89	87	86	9·9284	58° 0′
32° 0′	10·2758	54	50	46	42	10·2738	10·2042	36	31	25	20	10·2014	9·9284	83	81	79	78	9·9276	57° 50′
10′	10·2738	34	30	26	22	10·2718	10·2014	08	03	97	92	10·1986	9·9276	75	73	72	70	9·9268	40′
20′	10·2718	14	10	06	02	10·2698	10·1986	80	75	69	64	10·1958	9·9268	67	65	64	62	9·9260	30′
30′	10·2698	94	90	86	82	10·2678	10·1958	53	47	41	36	10·1930	9·9260	59	57	55	54	9·9252	20′
40′	10·2678	74	70	66	62	10·2658	10·1930	25	19	14	08	10·1903	9·9252	51	49	47	46	9·9244	10′
32° 50′	10·2658	55	51	47	43	10·2639	10·1903	97	91	86	80	10·1875	9·9244	42	41	39	38	9·9236	57° 0′
33° 0′	10·2639	35	31	27	23	10·2620	10·1875	69	64	58	53	10·1847	9·9236	34	33	31	29	9·9228	56° 50′
10′	10·2620	16	12	08	04	10·2600	10·1847	42	36	31	25	10·1820	9·9228	26	24	23	21	9·9219	40′
20′	10·2600	96	93	89	85	10·2581	10·1820	14	09	03	98	10·1792	9·9219	18	16	14	13	9·9211	30′
30′	10·2581	77	73	70	66	10·2562	10·1792	87	81	76	70	10·1765	9·9211	09	08	06	04	9·9203	20′
40′	10·2562	58	55	51	47	10·2543	10·1765	59	54	48	43	10·1737	9·9203	01	99	98	96	9·9194	10′
33° 50′	10·2543	39	36	32	28	10·2524	10·1737	32	26	21	16	10·1710	9·9194	93	91	89	87	9·9186	56° 0′
34° 0′	10·2524	21	17	13	09	10·2506	10·1710	05	99	94	88	10·1683	9·9186	84	82	81	79	9·9177	55° 50′
10′	10·2506	02	98	95	91	10·2487	10·1683	77	72	67	61	10·1656	9·9177	75	74	72	70	9·9169	40′
20′	10·2487	83	80	76	72	10·2469	10·1656	50	45	39	34	10·1629	9·9169	67	65	63	62	9·9160	30′
30′	10·2469	65	61	58	54	10·2450	10·1629	23	18	12	07	10·1602	9·9160	58	56	55	53	9·9151	20′
40′	10·2450	47	43	39	36	10·2432	10·1602	96	91	85	80	10·1575	9·9151	49	48	46	44	9·9142	10′
34° 50′	10·2432	29	25	21	18	10·2414	10·1575	69	64	58	53	10·1548	9·9142	41	39	37	35	9·9134	55° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	
55° to 65°	L. SECANTS.						L. TANGENTS.						L. SINES.						55° to 65°

35° to 45°	L. SINES.						L. TANGENTS.						L. SECANTS.						
	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	0′	2′	4′	6′	8′	10′	
35° 0′	9·7586	90	93	97	00	9·7604	9·8452	58	63	68	74	9·8479	10·0866	68	70	72	73	10·0875	54° 50′
10′	9·7604	07	11	15	18	9·7622	9·8479	84	90	95	01	9·8506	10·0875	77	79	81	82	10·0884	40′
20′	9·7622	25	29	32	36	9·7640	9·8506	11	17	22	27	9·8533	10·0884	86	88	90	91	10·0893	30′
30′	9·7640	43	47	50	54	9·7657	9·8533	38	43	49	54	9·8559	10·0893	95	97	99	00	10·0902	20′
40′	9·7657	61	64	68	71	9·7675	9·8559	65	70	75	81	9·8586	10·0902	04	06	08	09	10·0911	10′
35° 50′	9·7675	78	82	85	89	9·7692	9·8586	91	97	02	07	9·8613	10·0911	13	15	17	19	10·0920	54° 0′
36° 0′	9·7692	96	99	03	06	9·7710	9·8613	18	23	29	34	9·8639	10·0920	22	24	26	28	10·0930	53° 50′
10′	9·7710	13	16	20	23	9·7727	9·8639	44	50	55	60	9·8666	10·0930	31	33	35	37	10·0939	40′
20′	9·7727	30	34	37	40	9·7744	9·8666	71	76	82	87	9·8692	10·0939	41	43	44	46	10·0948	30′
30′	9·7744	47	51	54	58	9·7761	9·8692	97	03	08	13	9·8718	10·0948	50	52	54	56	10·0958	20′
40′	9·7761	64	68	71	74	9·7778	9·8718	24	29	34	40	9·8745	10·0958	59	61	63	65	10·0967	10′
36° 50′	9·7778	81	85	88	91	9·7795	9·8745	50	55	61	66	9·8771	10·0967	69	71	73	75	10·0977	53° 0′
37° 0′	9·7795	98	01	05	08	9·7811	9·8771	76	82	87	92	9·8797	10·0977	78	80	82	84	10·0986	52° 50′
10′	9·7811	15	18	21	25	9·7828	9·8797	03	08	13	18	9·8824	10·0986	88	90	92	94	10·0996	40′
20′	9·7828	31	35	38	41	9·7844	9·8824	29	34	39	45	9·8850	10·0996	98	00	01	03	10·1005	30′
30′	9·7844	48	51	54	58	9·7861	9·8850	55	60	65	71	9·8876	10·1005	07	09	11	13	10·1015	20′
40′	9·7861	64	67	71	74	9·7877	9·8876	81	86	92	97	9·8902	10·1015	17	19	21	23	10·1025	10′
37° 50′	9·7877	80	84	87	90	9·7893	9·8902	07	12	18	23	9·8928	10·1025	27	29	31	33	10·1035	52° 0′
38° 0′	9·7893	97	00	03	06	9·7910	9·8928	33	39	44	49	9·8954	10·1035	37	39	41	43	10·1045	51° 50′
10′	9·7910	13	16	19	22	9·7926	9·8954	59	65	70	75	9·8980	10·1045	47	49	51	53	10·1055	40′
20′	9·7926	29	32	35	38	9·7941	9·8980	85	90	96	01	9·9006	10·1055	57	59	61	63	10·1065	30′
30′	9·7941	45	48	51	54	9·7957	9·9006	11	16	22	27	9·9032	10·1065	67	69	71	73	10·1075	20′
40′	9·7957	60	64	67	70	9·7973	9·9032	37	42	47	53	9·9058	10·1075	77	79	81	83	10·1085	10′
38° 50′	9·7973	76	79	82	86	9·7989	9·9058	63	68	73	79	9·9084	10·1085	87	89	91	93	10·1095	51° 0′
39° 0′	9·7989	92	95	98	01	9·8004	9·9084	89	94	99	04	9·9110	10·1095	97	99	01	03	10·1105	50° 50′
10′	9·8004	07	10	14	17	9·8020	9·9110	15	20	25	30	9·9135	10·1105	07	09	11	13	10·1116	40′
20′	9·8020	23	26	29	32	9·8035	9·9135	40	46	51	56	9·9161	10·1116	18	20	22	24	10·1126	30′
30′	9·8035	38	41	44	47	9·8050	9·9161	66	71	76	82	9·9187	10·1126	28	30	32	34	10·1136	20′
40′	9·8050	53	56	60	63	9·8066	9·9187	92	97	02	07	9·9212	10·1136	38	41	43	45	10·1147	10′
39° 50′	9·8066	69	72	75	78	9·8081	9·9212	18	23	28	33	9·9238	10·1147	49	51	53	55	10·1157	50° 0′
40° 0′	9·8081	84	87	90	93	9·8096	9·9238	43	48	54	59	9·9264	10·1157	60	62	64	66	10·1168	49° 50′
10′	9·8096	99	02	05	08	9·8111	9·9264	69	74	79	84	9·9289	10·1168	70	72	75	77	10·1179	40′
20′	9·8111	14	17	20	22	9·8125	9·9289	95	00	05	10	9·9315	10·1179	81	83	85	87	10·1190	30′
30′	9·8125	28	31	34	37	9·8140	9·9315	20	25	30	35	9·9341	10·1190	92	94	96	98	10·1200	20′
40′	9·8140	43	46	49	52	9·8155	9·9341	46	51	56	61	9·9366	10·1200	03	05	07	09	10·1211	10′
40° 50′	9·8155	58	61	64	67	9·8169	9·9366	71	76	81	87	9·9392	10·1211	13	16	18	20	10·1222	49° 0′
41° 0′	9·8169	72	75	78	81	9·8184	9·9392	97	02	07	12	9·9417	10·1222	24	27	29	31	10·1233	48° 50′
10′	9·8184	87	90	93	95	9·8198	9·9417	22	27	32	38	9·9443	10·1233	35	38	40	42	10·1244	40′
20′	9·8198	01	04	07	10	9·8213	9·9443	48	53	58	63	9·9468	10·1244	47	49	51	53	10·1255	30′
30′	9·8213	16	18	21	24	9·8227	9·9468	73	78	83	88	9·9494	10·1255	58	60	62	64	10·1267	20′
40′	9·8227	30	33	35	38	9·8241	9·9494	99	04	09	14	9·9519	10·1267	69	71	73	76	10·1278	10′
41° 50′	9·8241	44	47	49	52	9·8255	9·9519	24	29	34	39	9·9544	10·1278	80	82	85	87	10·1289	48° 0′
42° 0′	9·8255	58	61	64	66	9·8269	9·9544	49	55	60	65	9·9570	10·1289	92	94	96	98	10·13	47° 50′
10′	9·8269	72	75	77	80	9·8283	9·9570	75	80	85	90	9·9595	10·1301	03	05	08	10	10·1312	40′
20′	9·8283	86	89	91	94	9·8297	9·9595	00	05	10	15	9·9621	10·1312	14	17	19	21	10·1324	30′
30′	9·8297	00	02	05	08	9·8311	9·9621	26	31	36	41	9·9646	10·1324	26	28	31	33	10·1335	20′
40′	9·8311	13	16	19	22	9·8324	9·9646	51	56	61	66	9·9671	10·1335	38	40	42	45	10·1347	10′
42° 50′	9·8324	27	30	32	35	9·8338	9·9671	76	81	86	91	9·9697	10·1347	49	52	54	56	10·1359	47° 0′
43° 0′	9·8338	41	43	46	49	9·8351	9·9697	02	07	12	17	9·9722	10·1359	61	63	66	68	10·1371	46° 50′
10′	9·8351	54	57	59	62	9·8365	9·9722	27	32	37	42	9·9747	10·1371	73	75	78	80	10·1382	40′
20′	9·8365	67	70	73	75	9·8378	9·9747	52	57	62	67	9·9773	10·1382	85	87	90	92	10·1394	30′
30′	9·8378	81	83	86	89	9·8391	9·9773	78	83	88	93	9·9798	10·1394	97	99	02	04	10·1406	20′
40′	9·8391	94	97	99	02	9·8405	9·9798	03	08	13	18	9·9823	10·1406	09	11	14	16	10·1418	10′
43° 50′	9·8405	07	10	12	15	9·8418	9·9823	28	33	38	43	9·9848	10·1418	21	23	26	28	10·1431	46° 0′
44° 0′	9·8418	20	23	26	28	9·8431	9·9848	53	58	64	69	9·9874	10·1431	33	36	38	40	10·1443	45° 50′
10′	9·8431	33	36	39	41	9·8444	9·9874	79	84	89	94	9·9899	10·1443	45	48	50	53	10·1455	40′
20′	9·8444	46	49	51	54	9·8457	9·9899	04	09	14	19	9·9924	10·1455	58	60	63	65	10·1468	30′
30′	9·8457	59	62	64	67	9·8469	9·9924	29	34	39	44	9·9949	10·1468	70	73	75	78	10·1480	20′
40′	9·8469	72	75	77	80	9·8482	9·9949	55	60	65	70	9·9975	10·1480	83	85	88	90	10·1493	10′
44° 50′	9·8482	85	87	90	92	9·8495	9·9975	80	85	90	95	10·0000	10·1493	95	98	00	03	10·1505	45° 0′
	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	10′	8′	6′	4′	2′	0′	45° to 55°
	L. COSINES.						L. COTANGENTS.						L. COSECANTS.						

LOGARITHMIC COSINES, COTANGENTS, AND COSECANTS.

35° to 45°	L. COSECANTS.					L. COTANGENTS.					L. COSINES.					
	0′	2′ 4′ 6′ 8′			10′	0′	2′ 4′ 6′ 8′			10′	0′	2′ 4′ 6′ 8′			10′	
35° 0′	10·2414	10 07 03 00			10·2396	10·1548	42 37 32 26			10·1521	9·9134	32 30 28 27			9·9125	54° 50′
10′	10·2396	93 89 85 82			10·2378	10·1521	16 10 05 99			10·1494	9·9125	23 21 19 18			9·9116	40′
20′	10·2378	75 71 68 64			10·2360	10·1494	89 83 78 73			10·1467	9·9116	14 12 10 09			9·9107	30′
30′	10·2360	57 53 50 46			10·2343	10·1467	62 57 51 46			10·1441	9·9107	05 03 01 00			9·9098	20′
40′	10·2343	39 36 32 29			10·2325	10·1441	35 30 25 19			10·1414	9·9098	96 94 92 91			9·9089	10′
35° 50′	10·2325	22 18 15 11			10·2308	10·1414	09 03 98 93			10·1387	9·9089	87 85 83 81			9·9080	54° 0′
36° 0′	10·2308	04 01 97 94			10·2290	10·1387	82 77 71 66			10·1361	9·9080	78 76 74 72			9·9070	53° 50′
10′	10·2290	87 84 80 77			10·2273	10·1361	56 50 45 40			10·1334	9·9070	69 67 65 63			9·9061	40′
20′	10·2273	70 66 63 60			10·2256	10·1334	29 24 18 13			10·1308	9·9061	59 57 56 54			9·9052	30′
30′	10·2256	53 49 46 42			10·2239	10·1308	03 97 92 87			10·1282	9·9052	50 48 46 44			9·9042	20′
40′	10·2239	36 32 29 26			10·2222	10·1282	76 71 66 60			10·1255	9·9042	41 39 37 35			9·9033	10′
36° 50′	10·2222	19 15 12 09			10·2205	10·1255	50 45 39 34			10·1229	9·9033	31 29 27 25			9·9023	53° 0′
37° 0′	10·2205	02 99 95 92			10·2189	10·1229	24 18 13 08			10·1203	9·9023	22 20 18 16			9·9014	52° 50′
10′	10·2189	85 82 79 75			10·2172	10·1203	97 92 87 82			10·1176	9·9014	12 10 08 06			9·9004	40′
20′	10·2172	69 65 62 59			10·2156	10·1176	71 66 61 55			10·1150	9·9004	02 00 99 97			9·8995	30′
30′	10·2156	52 49 46 42			10·2139	10·1150	45 40 35 29			10·1124	9·8995	93 91 89 87			9·8985	20′
40′	10·2139	36 33 29 26			10·2123	10·1124	19 14 08 03			10·1098	9·8985	83 81 79 77			9·8975	10′
37° 50′	10·2123	20 16 13 10			10·2107	10·1098	93 88 82 77			10·1072	9·8975	73 71 69 67			9·8965	52° 0′
38° 0′	10·2107	03 00 97 94			10·2090	10·1072	67 61 56 51			10·1046	9·8965	63 61 59 57			9·8955	51° 50′
10′	10·2090	87 84 81 78			10·2074	10·1046	41 35 30 25			10·1020	9·8955	53 51 49 47			9·8945	40′
20′	10·2074	71 68 65 62			10·2059	10·1020	15 10 04 99			10·0994	9·8945	43 41 39 37			9·8935	30′
30′	10·2059	55 52 49 46			10·2043	10·0994	89 84 78 73			10·0968	9·8935	33 31 29 27			9·8925	20′
40′	10·2043	40 36 33 30			10·2027	10·0968	63 58 53 47			10·0942	9·8925	23 21 19 17			9·8915	10′
38° 50′	10·2027	24 21 18 14			10·2011	10·0942	37 32 27 21			10·0916	9·8915	13 11 09 07			9·8905	51° 0′
39° 0′	10·2011	08 05 02 99			10·1996	10·0916	11 06 01 96			10·0890	9·8905	03 01 99 97			9·8895	50° 50′
10′	10·1996	93 90 86 83			10·1980	10·0890	85 80 75 70			10·0865	9·8895	93 91 89 87			9·8884	40′
20′	10·1980	77 74 71 68			10·1965	10·0865	60 54 49 44			10·0839	9·8884	82 80 78 76			9·8874	30′
30′	10·1965	62 59 56 53			10·1950	10·0839	34 29 24 18			10·0813	9·8874	72 70 68 66			9·8864	20′
40′	10·1950	47 44 40 37			10·1934	10·0813	08 03 98 93			10·0788	9·8864	62 59 57 55			9·8853	10′
39° 50′	10·1934	31 28 25 22			10·1919	10·0788	82 77 72 67			10·0762	9·8853	51 49 47 45			9·8843	50° 0′
40° 0′	10·1919	16 13 10 07			10·1904	10·0762	57 52 46 41			10·0736	9·8843	40 38 36 34			9·8832	49° 50′
10′	10·1904	01 98 95 92			10·1889	10·0736	31 26 21 16			10·0711	9·8832	30 28 25 23			9·8821	40′
20′	10·1889	86 83 80 78			10·1875	10·0711	05 00 95 90			10·0685	9·8821	19 17 15 13			9·8810	30′
30′	10·1875	72 69 66 63			10·1860	10·0685	80 75 70 65			10·0659	9·8810	08 06 04 02			9·8800	20′
40′	10·1860	57 54 51 48			10·1845	10·0659	54 49 44 39			10·0634	9·8800	97 95 93 91			9·8789	10′
40° 50′	10·1845	42 39 36 33			10·1831	10·0634	29 24 19 13			10·0608	9·8789	87 84 82 80			9·8778	49° 0′
41° 0′	10·1831	28 25 22 19			10·1816	10·0608	03 98 93 88			10·0583	9·8778	76 73 71 69			9·8767	48° 50′
10′	10·1816	13 10 07 05			10·1802	10·0583	78 73 68 62			10·0557	9·8767	65 62 60 58			9·8756	40′
20′	10·1802	99 96 93 90			10·1787	10·0557	52 47 42 37			10·0532	9·8756	53 51 49 47			9·8745	30′
30′	10·1787	85 82 79 76			10·1773	10·0532	27 22 17 12			10·0506	9·8745	42 40 38 36			9·8733	20′
40′	10·1773	70 67 65 62			10·1759	10·0506	01 96 91 86			10·0481	9·8733	31 29 27 24			9·8722	10′
41° 50′	10·1759	56 53 51 48			10·1745	10·0481	76 71 66 61			10·0456	9·8722	20 18 15 13			9·8711	48° 0′
42° 0′	10·1745	42 39 36 34			10·1731	10·0456	51 45 40 35			10·0430	9·8711	08 06 04 02			9·8699	47° 50′
10′	10·1731	28 25 23 20			10·1717	10·0430	25 20 15 10			10·0405	9·8699	97 95 92 90			9·8688	40′
20′	10·1717	14 11 09 06			10·1703	10·0405	00 95 90 85			10·0379	9·8688	86 83 81 79			9·8676	30′
30′	10·1703	00 98 95 92			10·1689	10·0379	74 69 64 59			10·0354	9·8676	74 72 69 67			9·8665	20′
40′	10·1689	87 84 81 78			10·1676	10·0354	49 44 39 34			10·0329	9·8665	62 60 58 55			9·8653	10′
42° 50′	10·1676	73 70 68 65			10·1662	10·0329	24 19 14 09			10·0303	9·8653	51 48 46 44			9·8641	47° 0′
43° 0′	10·1662	59 57 54 51			10·1649	10·0303	98 93 88 83			10·0278	9·8641	39 37 34 32			9·8629	46° 50′
10′	10·1649	46 43 41 38			10·1635	10·0278	73 68 63 58			10·0253	9·8629	27 25 22 20			9·8618	40′
20′	10·1635	33 30 27 25			10·1622	10·0253	48 43 38 33			10·0228	9·8618	15 13 10 08			9·8606	30′
30′	10·1622	19 17 14 11			10·1609	10·0228	22 17 12 07			10·0202	9·8606	03 01 98 96			9·8594	20′
40′	10·1609	06 03 01 98			10·1595	10·0202	97 92 87 82			10·0177	9·8594	91 89 86 84			9·8582	10′
43° 50′	10·1595	93 90 88 85			10·1582	10·0177	72 67 62 57			10·0152	9·8582	79 77 74 72			9·8569	46° 0′
44° 0′	10·1582	80 77 74 72			10·1569	10·0152	47 42 36 31			10·0126	9·8569	67 64 62 60			9·8557	45° 50′
10′	10·1569	67 64 61 59			10·1556	10·0126	21 16 11 06			10·0101	9·8557	55 52 50 47			9·8545	40′
20′	10·1556	54 51 49 46			10·1543	10·0101	96 91 86 81			10·0076	9·8545	42 40 37 35			9·8532	30′
30′	10·1543	41 38 36 33			10·1531	10·0076	71 66 61 56			10·0051	9·8532	30 27 25 22			9·8520	20′
40′	10·1531	28 25 23 20			10·1518	10·0051	45 40 35 30			10·0025	9·8520	17 15 12 10			9·8507	10′
44° 50′	10·1518	15 13 10 08			10·1505	10·0025	20 15 10 05			10·0000	9·8507	05 02 00 97			9·8495	45° 0′
	10′	8′ 6′ 4′ 2′			0′	10′	8′ 6′ 4′ 2′			0′	10′	8′ 6′ 4′ 2′			0′	45° to 55°
	L. SECANTS.					L. TANGENTS.					L. SINES.					

LOGARITHMIC SECANTS, TANGENTS, AND SINES.

N	0	1	2	3	4	5	6	7	8	9	2N
10	10000	10201	10404	10609	10816	11025	11236	11449	11664	11881	20, 21*
11	12100	12321	12544	12769	12996	13225	13456	13689	13924	14161	22, 23*
12	14400	14641	14884	15129	15376	15625	15876	16129	16384	16641	24, 25*
13	16900	17161	17424	17689	17956	18225	18496	18769	19044	19321	26, 27*
14	19600	19881	20164	20449	20736	21025	21316	21609	21904	22201	28, 29*
15	22500	22801	23104	23409	23716	24025	24336	24649	24964	25281	30, 31*
16	25600	25921	26244	26569	26896	27225	27556	27889	28224	28561	32, 33*
17	28900	29241	29584	29929	30276	30625	30976	31329	31684	32041	34, 35*
18	32400	32761	33124	33489	33856	34225	34596	34969	35344	35721	36, 37*
19	36100	36481	36864	37249	37636	38025	38416	38809	39204	39601	38, 39*
20	40000	40401	40804	41209	41616	42025	42436	42849	43264	43681	40, 41*
21	44100	44521	44944	45369	45796	46225	46656	47089	47524	47961	42, 43*
22	48400	48841	49284	49729	50176	50625	51076	51529	51984	52441	44, 45*
23	52900	53361	53824	54289	54756	55225	55696	56169	56644	57121	46, 47*
24	57600	58081	58564	59049	59536	60025	60516	61009	61504	62001	48, 49*
25	62500	63001	63504	64009	64516	65025	65536	66049	66564	67081	50, 51*
26	67600	68121	68644	69169	69696	70225	70756	71289	71824	72361	52, 53*
27	72900	73441	73984	74529	75076	75625	76176	76729	77284	77841	54, 55*
28	78400	78961	79524	80089	80656	81225	81796	82369	82944	83521	56, 57*
29	84100	84681	85264	85849	86436	87025	87616	88209	88804	89401	58, 59*
30	90000	90601	91204	91809	92416	93025	93636	94249	94864	95481	60, 61*
31	96100	96721	97344	97969	98596	99225	99856	100489	101124	101761	62, 63*
32	102400	103041	103684	104329	104976	105625	106276	106929	107584	108241	64, 65*
33	108900	109561	110224	110889	111556	112225	112896	113569	114244	114921	66, 67*
34	115600	116281	116964	117649	118336	119025	119716	120409	121104	121801	68, 69*
35	122500	123201	123904	124609	125316	126025	126736	127449	128164	128881	70, 71*
36	129600	130321	131044	131769	132496	133225	133956	134689	135424	136161	72, 73*
37	136900	137641	138384	139129	139876	140625	141376	142129	142884	143641	74, 75*
38	144400	145161	145924	146689	147456	148225	148996	149769	150544	151321	76, 77*
39	152100	152881	153664	154449	155236	156025	156816	157609	158404	159201	78, 79*
40	160000	160801	161604	162409	163216	164025	164836	165649	166464	167281	80, 81*
41	168100	168921	169744	170569	171396	172225	173056	173889	174724	175561	82, 83*
42	176400	177241	178084	178929	179776	180625	181476	182329	183184	184041	84, 85*
43	184900	185761	186624	187489	188356	189225	190096	190969	191844	192721	86, 87*
44	193600	194481	195364	196249	197136	198025	198916	199809	200704	201601	88, 89*
45	202500	203401	204304	205209	206116	207025	207936	208849	209764	210681	90, 91*
46	211600	212521	213444	214369	215296	216225	217156	218089	219024	219961	92, 93*
47	220900	221841	222784	223729	224676	225625	226576	227529	228484	229441	94, 95*
48	230400	231361	232324	233289	234256	235225	236196	237169	238144	239121	96, 97*
49	240100	241081	242064	243049	244036	245025	246016	247009	248004	249001	98, 99*
50	250000	251001	252004	253009	254016	255025	256036	257049	258064	259081	100, 101*
51	260100	261121	262144	263169	264196	265225	266256	267289	268324	269361	102, 103*
52	270400	271441	272484	273529	274576	275625	276676	277729	278784	279841	104, 105*
53	280900	281961	283024	284089	285156	286225	287296	288369	289444	290521	106, 107*
54	291600	292681	293764	294849	295936	297025	298116	299209	300304	301401	108, 109*
55	302500	303601	304704	305809	306916	308025	309136	310249	311364	321481	110, 111*
56	313600	314721	315844	316969	318096	319225	320356	321489	322624	323761	112, 113*
57	324900	326041	327184	328329	329476	330625	331776	332929	334084	335241	114, 115*
58	336400	337561	338724	339889	341056	342225	343396	344569	345744	346921	116, 117*
59	348100	349281	350464	351649	352836	354025	355216	356409	357604	358801	118, 119*
N	0	2	4	6	8	0*	2*	4*	6*	8*	2N

N	0	1	2	3	4	5	6	7	8	9	2N
60	360000	361201	362404	363609	364816	366025	367236	368449	369664	370881	120, 121°
61	372100	373321	374544	375769	376996	378225	379456	380689	381924	383161	122, 123°
62	384400	385641	386884	388129	389376	390625	391876	393129	394384	395641	124, 125°
63	396900	398161	399424	400689	401956	403225	404496	405769	407044	408321	126, 127°
64	409600	410881	412164	413449	414736	416025	417316	418609	419904	421201	128, 129°
65	422500	423801	425104	426409	427716	429025	430336	431649	432964	434281	130, 131°
66	435600	436921	438244	439569	440896	442225	443556	444889	446224	447561	132, 133°
67	448900	450241	451584	452929	454276	455625	456976	458329	459684	461041	134, 135°
68	462400	463761	465124	466489	467856	469225	470596	471969	473344	474721	136, 137°
69	476100	477481	478864	480249	481636	483025	484416	485809	487204	488601	138, 139°
70	490000	491401	492804	494209	495616	497025	498436	499849	501264	502681	140, 141°
71	504100	505521	506944	508369	509796	511225	512656	514089	515524	516961	142, 143°
72	518400	519841	521284	522729	524176	525625	527076	528529	529984	531441	144, 145°
73	532900	534361	535824	537289	538756	540225	541696	543169	544644	546121	146, 147°
74	547600	549081	550564	552049	553536	555025	556516	558009	559504	561001	148, 149°
75	562500	564001	565504	567009	568516	570025	571536	573049	574564	576081	150, 151°
76	577600	579121	580644	582169	583696	585225	586756	588289	589824	591361	152, 153°
77	592900	594441	595984	597529	599076	600625	602176	603729	605284	606841	154, 155°
78	608400	609961	611524	613089	614656	616225	617796	619369	620944	622521	156, 157°
79	624100	625681	627264	628849	630436	632025	633616	635209	636804	638401	158, 159°
80	640000	641601	643204	644809	646416	648025	649636	651249	652864	654481	160, 161°
81	656100	657721	659344	660969	662596	664225	665856	667489	669124	670761	162, 163°
82	672400	674041	675684	677329	678976	680625	682276	683929	685584	687241	164, 165°
83	688900	690561	692224	693889	695556	697225	698896	700569	702244	703921	166, 167°
84	705600	707281	708964	710649	712336	714025	715716	717409	719104	720801	168, 169°
85	722500	724201	725904	727609	729316	731025	732736	734449	736164	737881	170, 171°
86	739600	741321	743044	744769	746496	748225	749956	751689	753424	755161	172, 173°
87	756900	758641	760384	762129	763876	765625	767376	769129	770884	772641	174, 175°
88	774400	776161	777924	779689	781456	783225	784996	786769	788544	790321	176, 177°
89	792100	793881	795664	797449	799236	801025	802816	804609	806404	808201	178, 179°
90	810000	811801	813604	815409	817216	819025	820836	822649	824464	826281	180, 181°
91	828100	829921	831744	833569	835396	837225	839056	840889	842724	844561	182, 183°
92	846400	848241	850084	851929	853776	855625	857476	859329	861184	863041	184, 185°
93	864900	866761	868624	870489	872356	874225	876096	877969	879844	881721	186, 187°
94	883600	885481	887364	889249	891136	893025	894916	896809	898704	900601	188, 189°
95	902500	904401	906304	908209	910116	912025	913936	915849	917764	919681	190, 191°
96	921600	923521	925444	927369	929296	931225	933156	935089	937024	938961	192, 193°
97	940900	942841	944784	946729	948676	950625	952576	954529	956484	958441	194, 195°
98	960400	962361	964324	966289	968256	970225	972196	974169	976144	978121	196, 197°
99	980100	982081	984064	986049	988036	990025	992016	994009	996004	998001	198, 199°
N	0	2	4	6	8	0°	2°	4°	6°	8°	2N

Degrees.	NAT. SINES.									NAT. TANGENTS.									Degrees.
	Pos. Diff.	0′	10′	20′	30′	40′	50′	60′	Pos. Diff.	Pos. Diff.	0′	10′	20′	30′	40′	50′	60′	Pos. Diff.	
0	29	·0000	·0029	·0058	·0087	·0116	·0145	·0175	29	29	·0000	·0029	·0058	·0087	·0116	·0145	·0175	29	90
1	29	·0175	·0204	·0233	·0262	·0291	·0320	·0349	29	29	·0175	·0204	·0233	·0262	·0291	·0320	·0349	29	89
2	29	·0349	·0378	·0407	·0436	·0465	·0494	·0523	29	29	·0349	·0378	·0407	·0437	·0466	·0495	·0524	29	87
3	29	·0523	·0552	·0581	·0610	·0640	·0669	·0698	29	29	·0524	·0553	·0582	·0612	·0641	·0670	·0699	29	86
4	29	·0698	·0727	·0756	·0785	·0814	·0843	·0872	29	29	·0699	·0729	·0758	·0787	·0816	·0846	·0875	29	85
5	29	·0872	·0901	·0929	·0958	·0987	·1016	·1045	29	29	·0875	·0904	·0934	·0963	·0992	·1022	·1051	29	84
6	29	·1045	·1074	·1103	·1132	·1161	·1190	·1219	29	29	·1051	·1080	·1110	·1139	·1169	·1198	·1228	30	83
7	29	·1219	·1248	·1276	·1305	·1334	·1363	·1392	29	30	·1228	·1257	·1287	·1317	·1346	·1376	·1405	30	82
8	29	·1392	·1421	·1449	·1478	·1507	·1536	·1564	29	30	·1405	·1435	·1465	·1495	·1524	·1554	·1584	30	81
9	29	·1564	·1593	·1622	·1650	·1679	·1708	·1736	29	30	·1584	·1614	·1644	·1673	·1703	·1733	·1763	30	80
10	29	·1736	·1765	·1794	·1822	·1851	·1880	·1908	29	30	·1763	·1793	·1823	·1853	·1883	·1914	·1944	30	79
11	28	·1908	·1937	·1965	·1994	·2022	·2051	·2079	28	30	·1944	·1974	·2004	·2035	·2065	·2095	·2126	30	78
12	28	·2079	·2108	·2136	·2164	·2193	·2221	·2250	28	30	·2126	·2156	·2186	·2217	·2247	·2278	·2309	31	77
13	28	·2250	·2278	·2306	·2334	·2363	·2391	·2419	28	31	·2309	·2339	·2370	·2401	·2432	·2462	·2493	31	76
14	28	·2419	·2447	·2476	·2504	·2532	·2560	·2588	28	31	·2493	·2524	·2555	·2586	·2617	·2648	·2679	31	75
15	28	·2588	·2616	·2644	·2672	·2700	·2728	·2756	28	31	·2679	·2711	·2742	·2773	·2805	·2836	·2867	31	74
16	28	·2756	·2784	·2812	·2840	·2868	·2896	·2924	28	32	·2867	·2899	·2931	·2962	·2994	·3026	·3057	32	73
17	28	·2924	·2952	·2979	·3007	·3035	·3062	·3090	28	32	·3057	·3089	·3121	·3153	·3185	·3217	·3249	32	72
18	28	·3090	·3118	·3145	·3173	·3201	·3228	·3256	28	32	·3249	·3281	·3314	·3346	·3378	·3411	·3443	32	71
19	27	·3256	·3283	·3311	·3338	·3365	·3393	·3420	27	33	·3443	·3476	·3508	·3541	·3574	·3607	·3640	33	70
20	27	·3420	·3448	·3475	·3502	·3529	·3557	·3584	27	33	·3640	·3673	·3706	·3739	·3772	·3805	·3839	33	69
21	27	·3584	·3611	·3638	·3665	·3692	·3719	·3746	27	33	·3839	·3872	·3906	·3939	·3973	·4006	·4040	34	68
22	27	·3746	·3773	·3800	·3827	·3854	·3881	·3907	27	34	·4040	·4074	·4108	·4142	·4176	·4210	·4245	34	67
23	27	·3907	·3934	·3961	·3987	·4014	·4041	·4067	27	34	·4245	·4279	·4314	·4348	·4383	·4417	·4452	35	66
24	27	·4067	·4094	·4120	·4147	·4173	·4200	·4226	26	35	·4452	·4487	·4522	·4557	·4592	·4628	·4663	35	65
25	26	·4226	·4253	·4279	·4305	·4331	·4358	·4384	26	36	·4663	·4699	·4734	·4770	·4806	·4841	·4877	36	64
26	26	·4384	·4410	·4436	·4462	·4488	·4514	·4540	26	36	·4877	·4913	·4950	·4986	·5022	·5059	·5095	36	63
27	26	·4540	·4566	·4592	·4617	·4643	·4669	·4695	26	37	·5095	·5132	·5169	·5206	·5243	·5280	·5317	37	62
28	26	·4695	·4720	·4746	·4772	·4797	·4823	·4848	25	38	·5317	·5354	·5392	·5430	·5467	·5505	·5543	38	61
29	25	·4848	·4874	·4899	·4924	·4950	·4975	·5000	25	38	·5543	·5581	·5619	·5658	·5696	·5735	·5774	39	60
30	25	·5000	·5025	·5050	·5075	·5100	·5125	·5150	25	39	·5774	·5812	·5851	·5890	·5930	·5969	·6009	40	59
31	25	·5150	·5175	·5200	·5225	·5250	·5275	·5299	25	40	·6009	·6048	·6088	·6128	·6168	·6208	·6249	40	58
32	25	·5299	·5324	·5348	·5373	·5398	·5422	·5446	24	41	·6249	·6289	·6330	·6371	·6412	·6453	·6494	41	57
33	24	·5446	·5471	·5495	·5519	·5544	·5568	·5592	24	42	·6494	·6536	·6577	·6619	·6661	·6703	·6745	42	56
34	24	·5592	·5616	·5640	·5664	·5688	·5712	·5736	24	43	·6745	·6787	·6830	·6873	·6916	·6959	·7002	43	55
35	24	·5736	·5760	·5783	·5807	·5831	·5854	·5878	24	44	·7002	·7046	·7089	·7133	·7177	·7221	·7265	44	54
36	23	·5878	·5901	·5925	·5948	·5972	·5995	·6018	23	45	·7265	·7310	·7355	·7400	·7445	·7490	·7536	45	53
37	23	·6018	·6041	·6065	·6088	·6111	·6134	·6157	23	46	·7536	·7581	·7627	·7673	·7720	·7766	·7813	47	52
38	23	·6157	·6180	·6202	·6225	·6248	·6271	·6293	23	47	·7813	·7860	·7907	·7954	·8002	·8050	·8098	48	51
39	23	·6293	·6316	·6338	·6361	·6383	·6406	·6428	22	48	·8098	·8146	·8195	·8243	·8292	·8342	·8391	49	50
40	22	·6428	·6450	·6472	·6494	·6517	·6539	·6561	22	50	·8391	·8441	·8491	·8541	·8591	·8642	·8693	51	49
41	22	·6561	·6583	·6604	·6626	·6648	·6670	·6691	22	51	·8693	·8744	·8796	·8847	·8899	·8952	·9004	52	48
42	22	·6691	·6713	·6734	·6756	·6777	·6799	·6820	21	53	·9004	·9057	·9110	·9163	·9217	·9271	·9325	54	47
43	21	·6820	·6841	·6862	·6884	·6905	·6926	·6947	21	55	·9325	·9380	·9435	·9490	·9545	·9601	·9657	56	46
44	21	·6947	·6967	·6988	·7009	·7030	·7050	·7071	21	57	·9657	·9713	·9770	·9827	·9884	·9942	1·000	58	45
Degrees.	Neg. Diff.	60′	50′	40′	30′	20′	10′	0′	Neg. Diff.	Neg. Diff.	60′	50′	40′	30′	20′	10′	0′	Neg. Diff.	Degrees.
	NAT. COSINES.									NAT. COTANGENTS.									

Neg. Diff.	0′	10′	20′	30′	40′	50′	60′	Neg. Diff.	Degrees.
	NAT. COTANGENTS.								
	∞	343·77	171·89	114·59	85·94	68·75	57·29		89
	57·29	49·10	42·96	38·19	34·37	31·24	28·64		88
	28·64	26·43	24·54	22·90	21·47	20·21	19·08		87
	19·08	18·07	17·17	16·35	15·60	14·92	14·30		86
	14·30	13·73	13·20	12·71	12·25	11·83	11·43		85
	11·430	11·059	10·712	10·385	10·078	9·788	9·514		84
	9·514	9·255	9·010	8·777	8·556	8·345	8·144		83
	8·144	7·953	7·770	7·596	7·429	7·269	7·115		82
	7·115	6·968	6·827	6·691	6·561	6·435	6·314		81
	6·314	6·197	6·084	5·976	5·871	5·769	5·671		80
·092	5·671	5·576	5·485	5·396	5·309	5·226	5·145	·084	79
·077	5·145	5·066	4·989	4·915	4·843	4·773	4·705	·070	78
·065	4·705	4·638	4·574	4·511	4·449	4·390	4·331	·060	77
·055	4·331	4·275	4·219	4·165	4·113	4·061	4·011	·051	76
·048	4·011	3·962	3·914	3·867	3·821	3·776	3·732	·045	75
·042	3·732	3·689	3·647	3·606	3·566	3·526	3·487	·040	74
·037	3·487	3·450	3·412	3·376	3·340	3·305	3·271	·035	73
·033	3·271	3·237	3·204	3·172	3·140	3·108	3·078	·031	72
·030	3·078	3·047	3·018	2·989	2·960	2·932	2·904	·028	71
·027	2·904	2·877	2·850	2·824	2·798	2·773	2·747	·026	70
·0248	2·7475	2·7228	2·6985	2·6746	2·6511	2·6279	2·6051	·0232	69
·0222	2·6051	2·5826	2·5605	2·5386	2·5172	2·4960	2·4751	·0212	68
·0203	2·4751	2·4545	2·4342	2·4142	2·3945	2·3750	2·3559	·0194	67
·0187	2·3559	2·3369	2·3183	2·2998	2·2817	2·2637	2·2460	·0179	66
·0172	2·2460	2·2286	2·2113	2·1943	2·1775	2·1609	2·1445	·0166	65
·0160	2·1445	2·1283	2·1123	2·0965	2·0809	2·0655	2·0503	·0154	64
·0149	2·0503	2·0353	2·0204	2·0057	1·9912	1·9768	1·9626	·0144	63
·0139	1·9626	1·9486	1·9347	1·9210	1·9074	1·8940	1·8807	·0134	62
·0130	1·8807	1·8676	1·8546	1·8418	1·8291	1·8165	1·8040	·0126	61
·0122	1·8040	1·7917	1·7796	1·7675	1·7556	1·7437	1·7321	·0118	60
·0115	1·7321	1·7205	1·7090	1·6977	1·6864	1·6753	1·6643	·0111	59
·0108	1·6643	1·6534	1·6426	1·6319	1·6212	1·6107	1·6003	·0105	58
·0102	1·6003	1·5900	1·5798	1·5697	1·5597	1·5497	1·5399	·0099	57
·0097	1·5399	1·5301	1·5204	1·5108	1·5013	1·4919	1·4826	·0094	56
·0092	1·4826	1·4733	1·4641	1·4550	1·4460	1·4370	1·4281	·0090	55
·0087	1·4281	1·4193	1·4106	1·4019	1·3934	1·3848	1·3764	·0085	54
·0083	1·3764	1·3680	1·3597	1·3514	1·3432	1·3351	1·3270	·0081	53
·0079	1·3270	1·3190	1·3111	1·3032	1·2954	1·2876	1·2799	·0078	52
·0076	1·2799	1·2723	1·2647	1·2572	1·2497	1·2423	1·2349	·0074	51
·0073	1·2349	1·2276	1·2203	1·2131	1·2059	1·1988	1·1918	·0071	50
·0070	1·1918	1·1847	1·1778	1·1708	1·1640	1·1571	1·1504	·0068	49
·0067	1·1504	1·1436	1·1369	1·1303	1·1237	1·1171	1·1106	·0066	48
·0064	1·1106	1·1041	1·0977	1·0913	1·0850	1·0786	1·0724	·0063	47
·0062	1·0724	1·0661	1·0599	1·0538	1·0477	1·0416	1·0355	·0061	46
·0060	1·0355	1·0295	1·0235	1·0176	1·0117	1·0058	1·0000	·0059	45
Pos. Diff.	60′	50′	40′	30′	20′	10′	0′	Pos. Diff.	
	NAT. TANGENTS.								

Neg. Diff.	0′	10′	20′	30′	40′	50′	60′	Neg. Diff.	Degrees.
	NAT. COSINES								
0	1·0000	1·0000	1·0000	1·0000	·9999	·9999	·9998	0	89
0	·9998	·9998	·9997	·9997	·9996	·9995	·9994	1	88
1	·9994	·9993	·9992	·9990	·9989	·9988	·9986	1	87
2	·9986	·9985	·9983	·9981	·9980	·9978	·9976	2	86
2	·9976	·9974	·9971	·9969	·9967	·9964	·9962	2	85
3	·9962	·9959	·9957	·9954	·9951	·9948	·9945	3	84
3	·9945	·9942	·9939	·9936	·9932	·9929	·9925	4	83
4	·9925	·9922	·9918	·9914	·9911	·9907	·9903	4	82
4	·9903	·9899	·9894	·9890	·9886	·9881	·9877	4	81
5	·9877	·9872	·9868	·9863	·9858	·9853	·9848	5	80
5	·9848	·9843	·9838	·9833	·9827	·9822	·9816	5	79
6	·9816	·9811	·9805	·9799	·9793	·9787	·9781	6	78
6	·9781	·9775	·9769	·9763	·9757	·9750	·9744	6	77
7	·9744	·9737	·9730	·9724	·9717	·9710	·9703	7	76
7	·9703	·9696	·9689	·9681	·9674	·9667	·9659	7	75
8	·9659	·9652	·9644	·9636	·9628	·9621	·9613	8	74
8	·9613	·9605	·9596	·9588	·9580	·9572	·9563	8	73
9	·9563	·9555	·9546	·9537	·9528	·9520	·9511	9	72
9	·9511	·9502	·9492	·9483	·9474	·9465	·9455	9	71
10	·9455	·9446	·9436	·9426	·9417	·9407	·9397	10	70
10	·9397	·9387	·9377	·9367	·9356	·9346	·9336	10	69
11	·9336	·9325	·9315	·9304	·9293	·9283	·9272	11	68
11	·9272	·9261	·9250	·9239	·9228	·9216	·9205	11	67
11	·9205	·9194	·9182	·9171	·9159	·9147	·9135	12	66
12	·9135	·9124	·9112	·9100	·9088	·9075	·9063	12	65
12	·9063	·9051	·9038	·9026	·9013	·9001	·8988	13	64
13	·8988	·8975	·8962	·8949	·8936	·8923	·8910	13	63
13	·8910	·8897	·8884	·8870	·8857	·8843	·8829	14	62
14	·8829	·8816	·8802	·8788	·8774	·8760	·8746	14	61
14	·8746	·8732	·8718	·8704	·8689	·8675	·8660	15	60
15	·8660	·8646	·8631	·8616	·8601	·8587	·8572	15	59
15	·8572	·8557	·8542	·8526	·8511	·8496	·8480	15	58
15	·8480	·8465	·8450	·8434	·8418	·8403	·8387	16	57
16	·8387	·8371	·8355	·8339	·8323	·8307	·8290	16	56
16	·8290	·8274	·8258	·8241	·8225	·8208	·8192	16	55
17	·8192	·8175	·8158	·8141	·8124	·8107	·8090	17	54
17	·8090	·8073	·8056	·8039	·8021	·8004	·7986	18	53
17	·7986	·7969	·7951	·7934	·7916	·7898	·7880	18	52
18	·7880	·7862	·7844	·7826	·7808	·7790	·7771	18	51
18	·7771	·7753	·7735	·7716	·7698	·7679	·7660	19	50
19	·7660	·7642	·7623	·7604	·7585	·7566	·7547	19	49
19	·7547	·7528	·7509	·7490	·7470	·7451	·7431	19	48
20	·7431	·7412	·7392	·7373	·7353	·7333	·7314	20	47
20	·7314	·7294	·7274	·7254	·7234	·7214	·7193	20	46
20	·7193	·7173	·7153	·7133	·7112	·7092	·7071	21	45
Pos. Diff.	60′	50′	40′	30′	20′	10′	0′	Pos. Diff.	
	NAT. SINES.								

Degrees.	Pos. Diff.	NAT. SECANTS. 0′	10′	20′	30′	40′	50′	60′	Pos. Diff.	Neg. Diff.	NAT. COSECANTS. 0′	10′	20′	30′	40′	50′	60′	Neg. Diff.	Degrees.
0	0	1·0000	1·0000	1·0000	1·0000	1·0001	1·0001	1·0002	1		∞	343·78	171·89	114·59	85·95	68·76	57·30		90
1	1	1·0002	1·0002	1·0003	1·0003	1·0004	1·0005	1·0006	1		57·30	49·11	42·98	38·20	34·38	31·26	28·65		89
2	1	1·0006	1·0007	1·0008	1·0010	1·0011	1·0012	1·0014	1		28·65	26·45	24·56	22·93	21·49	20·23	19·11		88
3	2	1·0014	1·0015	1·0017	1·0019	1·0021	1·0022	1·0024	2		19·11	18·10	17·20	16·38	15·64	14·96	14·34		87
4	2	1·0024	1·0027	1·0029	1·0031	1·0033	1·0036	1·0038	2		14·34	13·76	13·23	12·75	12·29	11·87	11·47		86
5	3	1·0038	1·0041	1·0043	1·0046	1·0049	1·0052	1·0055	3		11·47	11·10	10·76	10·43	10·13	9·84	9·567		85
6	3	1·0055	1·0058	1·0061	1·0065	1·0068	1·0072	1·0075	3		9·567	9·309	9·065	8·834	8·614	8·405	8·206		84
7	4	1·0075	1·0079	1·0082	1·0086	1·0090	1·0094	1·0098	4		8·206	8·016	7·834	7·661	7·496	7·337	7·185		83
8	4	1·0098	1·0102	1·0107	1·0111	1·0116	1·0120	1·0125	5		7·185	7·040	6·900	6·765	6·636	6·512	6·392		82
9	5	1·0125	1·0129	1·0134	1·0139	1·0144	1·0149	1·0154	5		6·392	6·277	6·166	6·059	5·955	5·855	5·759		81
10	5	1·0154	1·0160	1·0165	1·0170	1·0176	1·0181	1·0187	6	·091	5·759	5·665	5·575	5·487	5·403	5·320	5·241	·082	80
11	6	1·0187	1·0193	1·0199	1·0205	1·0211	1·0217	1·0223	6	·075	5·421	5·164	5·089	5·016	4·945	4·876	4·810	·069	79
12	7	1·0223	1·0230	1·0236	1·0243	1·0249	1·0256	1·0263	7	·063	4·810	4·745	4·682	4·620	4·560	4·502	4·445	·058	78
13	7	1·0263	1·0270	1·0277	1·0284	1·0291	1·0299	1·0306	7	·054	4·445	4·390	4·336	4·284	4·232	4·182	4·134	·050	77
14	8	1·0306	1·0314	1·0321	1·0329	1·0337	1·0345	1·0353	8	·047	4·134	4·086	4·039	3·994	3·950	3·906	3·864	·043	76
15	8	1·0353	1·0361	1·0369	1·0377	1·0386	1·0394	1·0403	9	·041	3·864	3·822	3·782	3·742	3·703	3·665	3·628	·038	75
16	9	1·0403	1·0412	1·0421	1·0429	1·0439	1·0448	1·0457	9	·036	3·628	3·592	3·556	3·521	3·487	3·453	3·420	·034	74
17	9	1·0457	1·0466	1·0476	1·0485	1·0495	1·0505	1·0515	10	·031	3·420	3·388	3·356	3·326	3·295	3·265	3·236	·030	73
18	10	1·0515	1·0525	1·0535	1·0545	1·0555	1·0566	1·0576	10	·028	3·236	3·207	3·179	3·152	3·124	3·098	3·072	·027	72
19	11	1·0576	1·0587	1·0598	1·0608	1·0619	1·0631	1·0642	11	·025	3·072	3·046	3·021	2·996	2·971	2·947	2·9238	·024	71
20	11	1·0642	1·0653	1·0665	1·0676	1·0688	1·0700	1·0711	12	·0228	2·9238	2·9006	2·8779	2·8555	2·8334	2·8117	2·7904	·0217	70
21	12	1·0711	1·0723	1·0736	1·0748	1·0760	1·0773	1·0785	12	·0206	2·7904	2·7695	2·7488	2·7285	2·7085	2·6888	2·6695	·0197	69
22	13	1·0785	1·0798	1·0811	1·0824	1·0837	1·0850	1·0864	13	·0188	2·6695	2·6504	2·6316	2·6131	2·5949	2·5770	2·5593	·0179	68
23	13	1·0864	1·0877	1·0891	1·0904	1·0918	1·0932	1·0946	14	·0172	2·5593	2·5419	2·5247	2·5078	2·4912	2·4748	2·4586	·0164	67
24	14	1·0946	1·0961	1·0975	1·0989	1·1004	1·1019	1·1034	15	·0157	2·4586	2·4426	2·4269	2·4114	2·3961	2·3811	2·3662	·0151	66
25	15	1·1034	1·1049	1·1064	1·1079	1·1095	1·1110	1·1126	16	·0145	2·3662	2·3515	2·3371	2·3228	2·3088	2·2949	2·2812	·0138	65
26	16	1·1126	1·1142	1·1158	1·1174	1·1190	1·1207	1·1223	16	·0133	2·2812	2·2677	2·2543	2·2412	2·2282	2·2153	2·2027	·0126	64
27	17	1·1223	1·1240	1·1257	1·1274	1·1291	1·1308	1·1326	17	·0123	2·2027	2·1902	2·1779	2·1657	2·1537	2·1418	2·1301	·0116	63
28	18	1·1326	1·1343	1·1361	1·1379	1·1397	1·1415	1·1434	18	·0115	2·1301	2·1185	2·1070	2·0957	2·0846	2·0736	2·0627	·0110	62
29	19	1·1434	1·1452	1·1471	1·1490	1·1509	1·1528	1·1547	19	·0106	2·0627	2·0519	2·0413	2·0308	2·0204	2·0101	2·0000	·0101	61
30	20	1·1547	1·1566	1·1586	1·1606	1·1626	1·1646	1·1666	20	·0099	2·0000	1·9900	1·9801	1·9703	1·9606	1·9511	1·9416	·0095	60
31	21	1·1666	1·1687	1·1707	1·1728	1·1749	1·1770	1·1792	21	·0092	1·9416	1·9323	1·9230	1·9139	1·9048	1·8959	1·8871	·0089	59
32	22	1·1792	1·1813	1·1835	1·1857	1·1879	1·1901	1·1924	22	·0086	1·8871	1·8783	1·8697	1·8612	1·8527	1·8443	1·8361	·0086	58
33	23	1·1924	1·1946	1·1969	1·1992	1·2015	1·2039	1·2062	23	·0081	1·8361	1·8279	1·8198	1·8118	1·8039	1·7960	1·7883	·0078	57
34	24	1·2062	1·2086	1·2110	1·2134	1·2158	1·2183	1·2208	25	·0076	1·7883	1·7806	1·7730	1·7655	1·7581	1·7507	1·7434	·0074	56
35	25	1·2208	1·2233	1·2258	1·2283	1·2309	1·2335	1·2361	25	·0071	1·7434	1·7362	1·7291	1·7221	1·7151	1·7081	1·7013	·0069	55
36	26	1·2361	1·2387	1·2413	1·2440	1·2467	1·2494	1·2521	27	·0067	1·7013	1·6945	1·6878	1·6812	1·6746	1·6681	1·6616	·0065	54
37	28	1·2521	1·2549	1·2577	1·2605	1·2633	1·2661	1·2690	28	·0063	1·6616	1·6553	1·6489	1·6427	1·6365	1·6303	1·6243	·0061	53
38	29	1·2690	1·2719	1·2748	1·2778	1·2807	1·2837	1·2868	30	·0060	1·6243	1·6183	1·6123	1·6064	1·6005	1·5948	1·5890	·0058	52
39	31	1·2868	1·2898	1·2929	1·2960	1·2991	1·3022	1·3054	31	·0056	1·5890	1·5833	1·5777	1·5721	1·5666	1·5611	1·5557	·0054	51
40	32	1·3054	1·3086	1·3118	1·3151	1·3184	1·3217	1·3250	33	·0053	1·5557	1·5504	1·5450	1·5398	1·5345	1·5294	1·5243	·0051	50
41	34	1·3250	1·3284	1·3318	1·3352	1·3386	1·3421	1·3456	35	·0050	1·5243	1·5192	1·5141	1·5092	1·5042	1·4993	1·4945	·0049	49
42	36	1·3456	1·3492	1·3527	1·3563	1·3600	1·3636	1·3673	37	·0048	1·4945	1·4897	1·4849	1·4802	1·4755	1·4709	1·4663	·0046	48
43	38	1·3673	1·3711	1·3748	1·3786	1·3824	1·3863	1·3902	39	·0045	1·4663	1·4617	1·4572	1·4527	1·4483	1·4439	1·4396	·0044	47
44	40	1·3902	1·3941	1·3980	1·4020	1·4061	1·4101	1·4142	41	·0043	1·4396	1·4352	1·4310	1·4267	1·4225	1·4183	1·4142	·0042	46
Degrees.	Neg. Diff.	60′	50′	40′	30′	20′	10′	0′	Neg. Diff.	Pos. Diff.	60′	50′	40′	30′	20′	10′	0′	Pos. Diff.	
		NAT. COSECANTS.									NAT. SECANTS.								

REVIEW.

Gyrostatics and Rotational Motion. By A. GRAY.
Pp. 530. 42s. 1918. (Macmillan.)

In opening the Section on Didactics at the Cambridge International Mathematical Congress 1912, the chairman, Mr. C. Godfrey, had occasion to mention "the Exhibition." But turning to the index of the volumes of the Proceedings, the existence cannot be traced of any such Exhibition.

It was a display of scientific books of all the chief publishers of the world, a rival to a similar display at the preceding Congress in Heidelberg, and at the same time a collection of simple mechanical apparatus suitable for mathematical instruction; also of calculating machines, very complete of every sort. A catalogue of the apparatus had been printed, and would have added to the interest, if given a place in the volumes of the Proceedings.

The chief attraction to the foreign visitor was the show of Kelvin's gyrostats and their improvements, in action by Dr. James Gray, son of our author. Much of the obscurity was cleared up at a glance, due to the confused diagrams as given in the *Natural Philosophy* of Thomson and Tait.

The preface of our author explains the scope of his treatment of Gyroscopic Theory—"to supply a systematic discussion of gyrostatic action and rotational motion, which may be of use to students of dynamics and practical men.

To give a training in the analytical and numerical discussion of problems of actual apparatus, accompanied by the practical study of gyrostatic devices. As a rule the discussion of dynamical and especially of gyrostatic problems in the lecture room and text book has either been restricted to one or two simple cases, or when more comprehensive, been far too much an affair of Euler's or Lagrange's equations; which, by providing a walled-in path along which the mind can travel, withdraw its attention from the incidents, often exceedingly instructive, which attend its progress."

Lagrange's Equations have become a stock piece of cram, confidently expected to be set in every examination. But they are far too delicate a tool to be put into the hand of a novice; and Lagrange himself cannot be said to have understood his own Equations thoroughly, unaware as he was of the distinction between coordinates holonomic and anholonomic, to use the cacophonic jargon. As for Euler's Equations, who is there among us can say he thoroughly understands and can interpret every term of them, and point out where the coordinates are inapplicable?

The author follows Thomson and Tait in a free use of the fluxional notation, of a dot above a letter. The idea of the Fluxion is preferable compared with the Differential Coefficient, dot-age versus d-ism; but it lost the victory from the difficulty of printing, though so easy to write.

It is related that Lagrange wrote the fluxion in his manuscript of the *Mécanique analytique*, and being a careful methodical man, he sent the whole manuscript complete to the printer. But when the mass of proofs arrived, he found the printer to suit his convenience had substituted the dash for the dot, replacing $\dot{x}$ by x'; and it was then too much expense and trouble to make the correction.

Professor Bryan's suggestion removes the whole difficulty, if we practise writing and then printing the dot, not above, but after the letter, like the dash, and then $x^{\cdot}$, $x^{\cdot\cdot}$ give the printer no more trouble than x', x''. Because $\dot{x}$ and $\ddot{x}$ require a separate line above for the dots; and as several letters of the alphabet are already in their dotage, they cannot be made more dotty. The saving of expense would have been considerable on Bryan's principle, if adopted by Gray in this book.

The author is not of the Lagrange-Laplace school, too much in favour to-day, in suppressing all figures and diagrams, trusting to intuition, or drawing them with a finger in the air as a visualisation. On the contrary the work is profusely illustrated with careful drawings.

An apparatus is shown in Fig. 30 (*b*), p. 128, suitable for the lecture table, as visible to a large class, for showing off gyroscopic motion. Instead of a

spinning top, requiring string, or a gyrostat actuated by an electric motor, an ordinary bicycle wheel is taken, moving freely on ball bearings, with the hub screwed to the end of the suspending stalk. The wheel can be spun by hand, and the axle projected in any manner, to show off the motion, undulating, looped, or dropping from a cusp.

Kelvin's rule "hurry the precession and the axle rises against gravity" can be illustrated, the instinctive action in riding a bicycle; as well as the reverse effect of retarding the precession; and if the precession is stopped the axle falls down vertical. This is the great principle for the inventor to grasp, in guiding a new design of harnessing a flywheel.

The suspension of the axle is of the astronomical Alt-Azimuth nature, and the three angles employed in the analytical discussion, θ, ϕ, ψ, introduced by Euler in 1760, are still in use, in which θ may be called the altitude, ψ the azimuth, and ϕ the hour-angle, angular displacement of the wheel over the axle.

There is a difference of opinion among writers as to the measurement of altitude θ. Darboux and Klein reckon θ from the upper vertical, the zenith as in Fig. 30 (a); but in the apparatus of Fig. 30 (b) it is more convenient to change to the nadir, downward vertical of the position of rest. The change from one reckoning to the other must be practised (p. 329); as in the ordinary spinning top asleep, and in the centrifuge, the motion is in the neighbourhood of the zenith upward vertical, realised by the large wheel of Fig. 30 (a).

But starting from the position of rest, give the axle the displacement θ. Then holding the axle at this angle θ, give it the displacement ψ in azimuth.

With vector representation of rotation on a right-handed screw, positive rotation of ψ will be with the sun, deasil. But with a change to the zenith, ψ would be measured against the sun, widdershins, and with the rotation of the Earth. These differences in space relation are difficult to indicate on the plane of a diagram, and here the Maxwell top comes in useful on the table, to make them clear.

Generally in any of these conventional representations of a sphere on a plane, as in Fig. 1, p. 39, the figure should be looked at as a star chart, on the concave side of the celestial sphere; not as a sea chart, on the convex surface of the terrestrial globe.

Euler's angle ϕ may be called hour-angle, by analogy with astronomical use, where the rotating gyroscopic wheel is the Earth itself, and the vertical is the equivalent of the pole of the ecliptic, in the theory of Precession. The physical interpretation of ϕ is rather delicate, as requiring angular displacement about a moving axis.

In making the ψ displacement in azimuth, with θ fixed in altitude, the wheel of Fig. 30 must be held fixed on the axle by the thumb; otherwise, if free to turn on the axle considered smooth, it will be found to have turned round over the axle, and ϕ will have come into existence.

But after the step ψ has been made, the thumb can release the wheel, and the displacement ϕ can follow, as shown in Fig. 12, p. 71; where the zenith measurement is employed; but as a star chart, the vectors are left-handed screws.

If the thumb was not applied to keep the wheel from moving round, then in any conical movement of the axle, the wheel would rub over the axle. This is easily shown with a pencil or penholder held lightly between finger and thumb, and revolved conically by a finger applied at the point. In a complete circuit, the body will be seen to have turned round through an angle proportional to the conical solid angle swept out.

In this experiment Aristotle's dictum can be disproved, that it is impossible to turn a smooth sphere. But spitted on a smooth diametral axle stalk, the sphere can be revolved to any extent by moving the axle round in a conical movement; the sphere always coming to rest with the axle.

These are the preliminary questions discussed in Chapter IV, after which in Chapter V the application is made to the gyroscopic motion, tractable by the Elliptic Function; and here the reader must not be deterred, if he is ambitious to look across the frontier of the Science.

This function seems created to speak the language of gyroscopic motion, long before the name was invented. Euler was using it unconsciously in his

Dynamics, 1760, for expressing the motion of θ in altitude, by comparing it with a corresponding beat of a plane pendulum.

But a corresponding interpretation of azimuth ψ was beyond his powers, as requiring the Third Elliptic Integral, and the world had to wait another sixty years for the developments of Legendre and Jacobi.

The invention of the theta-function made the expression analytically complete of the Third Elliptic Integral. But as the integrals which occur in gyroscopic motion are of Legendre's circular kind, with imaginary parameter, the argument of the theta-function is complex, and so of no practical value for numerical computation.

Here Abel's theory of the pseudo-elliptic integral can be utilised for giving an expression in a finite algebraical form, by choosing the elliptic parameter a rational aliquot part fraction of a period; and the construction of a series of such cases of soluble top motion is in interesting analytical diversion. A few examples are given here in the final chapter, and the results can be shown on a stereoscopic card, as drawn by the late Mr. T. I. Dewar. Professor Gray has checked some of the results by a direct calculation of the integrals by quadrature in Chapter XII, p. 259, the only practical procedure in the intermediate state of a general case of motion.

In the symmetrical top, of uniaxial symmetry, the vector of angular momentum (A.M.) describes a curve in a horizontal plane, which can be identified with a Poinsot herpolhode, and the projection on this plane of a point on the axle will describe its hodograph.

In a complete treatment, by the consideration of hour angle ϕ as well as azimuth ψ, a similar statement can be made, where the fixed horizontal plane of the azimuth ψ is replaced for ϕ by a plane fixed at right angles to the axis of the top.

Thus ϕ and ψ may be interchanged to give a new state of top motion; and Jacobi's statement is explained, that the most general state of top motion can be resolved into two Poinsot movements.

This Poinsot state is the representation of the motion of a body of any shape about a fixed point, say about the C.G., when tossed in the air.

The C.G. proceeds to describe a parabola, and taking a stand at the C.G., the body wobbles about it in a very complicated manner, which can be studied at ease in the Maxwell top on the table, twirled by a finger and thumb, when the screws are adjusted in any manner so as to bring the C.G. into coincidence with the point in the supporting cup.

Poinsot reduced this complication to order by taking the A.M. vector, now fixed in direction and magnitude, and drawing a plane through its end at right angles. Then if the momental ellipsoid is rolled on this plane, it will accompany the body as if fixed in it, the angular velocity about the instantaneous axis being made proportional to the radius vector of the ellipsoid.

It is conducive to simplicity if Prof. Gray would make the equations of his Chapter XXI homogeneous, by the introduction of a quantity, which may be denoted by D, such that

$$Ap^2+Bq^2+Cr^2=2T=Dh^2, \quad A^2p^2+B^2q^2+C^2r^2=H^2=D^2h^2,$$

and then (A, B, C, D) are of the same dimensions, and also (p, q, r, h).

And Poinsot's polhode is given by the intersection of the two ellipsoids

$$Ax^2+By^2+Cz^2=D\delta^2, \quad A^2x^2+B^2y^2+C^2z^2=D^2\delta^2,$$

the first being the momental ellipsoid; and then δ is the distance from O of the fixed plane on which it rolls, to trace out the herpolhode. The identification with the geometry of Darboux's representation by the deformable hyperboloid is facilitated thereby.

The simplicity is evident then in Dynamics of abstracting the gaze from the body and its visible motion about a changing axis of rotation, and in fixing the attention first on the invisible axis of angular momentum (A.M.), which in this case of no external applied force is a fixed vector. Here Maxwell's top comes in useful, as the motion of the instantaneous axis is revealed on it by a coloured cardboard disc, placed on the axle. But apparently there is no demand to-day for this top in Dynamical instruction, and it is no longer manufactured for sale.

Kirchoff's Kinetic Analogue of Chapter XXII is useful not merely in its application to the problem of the stability and springing of a shaft, but is of analytical interest in showing a double interpretation of the equations of gyroscopic motion. The Analogue states that if a shaft is sprung into a general helix under the action of a wrench at each end, composed of equal opposing forces and couples, the central line is a curve such that if a point travels along it with a certain constant velocity, the tangent of the line will follow the direction of the axle of a certain top in associated motion. The velocity must be chosen so that a wave of the helix is passed over in the period of the motion of the top. In this way the slight tremor of nutation of a top asleep upright is associated with the stability of a screw shaft between bearings, transmitting a thrust and a couple, and sprung slightly.

Problems on the vibration of a system of bodies, flexible, elastic, or jointed, may be treated in the manner called elementary, without the use of the differential equation, when the associated steady motion is considered of bodily rotation about an axis, performed in the same period as the vibration; and when the displacement is small, the shadow on a wall will show the vibration. In this way we compare the simple and conical pendulum, and discuss the problem of the bell and clapper, a loaded string, a vertical rope, or Kelvin's chain of gyrostats, model of an electromagnetic wave, with circular polarisation, and the treatment is carried out on elementary principles, as here in Chapter XXII. The Hindu rope trick, on these dynamical considerations, is no longer a physical impossibility.

The greatest spinning top we know is the Earth itself, revolving once in twenty-four hours, and precessing at a rate of 50″ per annum, thus making the year 20 minutes shorter, the pole completing a circuit of the sky in 26,000 years. The problem is described here in Chapter I, and resumed in Chapters X, XI, with full development, in a manner that should satisfy the physical astronomer.

The baffling question of the "Variation of Latitude" is exciting the interest of astronomers. According to Chandler's observations the period of a variation is fourteen months, but in Euler's theory a rigid Earth, with $\frac{A,C}{C-A}=305,\ 306$, should complete a wobble in about ten months; the discrepancy is laid to the elastic yielding of the body of the Earth.

This wobble could be increased, and swing got up in the Earth, by well timed salvoes of artillery, such as we have been hearing in the years past. The idea was anticipated by Maxwell, who imagined the effect of a man going to bed when his latitude is a minimum and getting up when at a maximum; the statement will be found given as an example in Routh's *Advanced Rigid Dynamics*.

G. GREENHILL.

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BOOKS RECEIVED, CONTENTS OF JOURNALS, ETC.

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Empirical Formulas. By T. RUNNING. Pp. 143. 7s. net. 1917. (Wiley, Chapman & Hall.)

Differential and Integral Calculus. By H. P. PHILLIPS. Pp. 162 + 194. 9s. 6d. net. 1916-17. (Wiley, Chapman & Hall.)

Integral Calculus. By H. P. PHILLIPS. Pp. 194. 6s. net. 1917. (Wiley, Chapman & Hall.)

Undergraduate Mathematics Clubs. Edited by R. C. ARCHIBALD. *Address.* Pp. 348-353. H. E. HAWKES. *Constructions with Double-Edged Ruler.* Pp. 357-358. R. C. ARCHIBALD. *The Cattle Problem of Archimedes.* Pp. 411-414. R. C. ARCHIBALD. (Reprints from *Am. Math. Monthly*, Oct. and Nov. 1918.)

Solid Geometry: Including the Mensuration of Surfaces and Solids. By R. S. HEATH. 4th edition. 4s. 1919. (Messrs. Rivington.)

A Treatise on Gyrostatics and Rotational Motion. By A. GRAY. Pp. xx + 530. 42s. net. 1919. (Macmillan.)

Dynamics. Part II. By R. C. FAWDRY. Pp. viii + 179-355 + vii.

Metodi di Geometria Descrittiva. By G. LORIA. Pp. xx + 353. 1919. (Hoepli, Milan.)

The Philosophy of Mathematics. By J. B. SHAW. Pp. vii + 206. 6s. 1918. (Open Court.)

Elementary Mensuration, Constructive Plane Geometry, and Numerical Trigonometry. Pp. viii + 169. 3s. 6d. 1919. (Macmillan.)

Mathematical Papers for Admission into the Royal Military Academy and the Royal Military College, and Papers in Elementary Engineering for Naval Cadetships. July and Nov. 1918. Edited by R. M. MILNE (with Answers). Pp. 36. 1s. 3d. net. 1919. (Macmillan.)

Fermat's Last Theorem. Three Proofs by Elementary Algebra. By M. CASHMORE. Revised Edition. Pp. 54. 2s. 6d. net. 1918. (Bell & Sons.)

Mesures Décimales. By M. VITTRANT, S.J. (Reprint from Bull. del' Univ. l' Aurore, Shanghai.) Pp. 9. Feb. 1919.

Sopra una trasformazione doppia del terz' ordine. Pp. 11. [Reprinted from Annaes da Academia Polytechnica do Porto, ix. 1914.] V. RETALI. *Sur une courbe transcendante* [tractrice]. Pp. 5. [Reprint from Annaes . . . do Porto, vii. 1912]. V. RETALI.

The American Journal of Mathematics.

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Groups generated by Two Operators whose Relative Transforms are equal to each other. Pp. 1-4. G. A. MILLER. *A Classification of General* (2, 3) *Point Correspondences between two Planes.* Pp. 5-24. T. R. HOLLCROFT. *The Classification of Plane Involutions of Order* (3). Pp. 25-48. A. M. HOWE. *On Surfaces containing a System of Cubics that do not constitute a Pencil.* Pp. 49-59. C. H. SISAM. *An Isoperimetric Problem with variable End-Points.* Pp. 59-78. A. S. MERRILL.

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Asymptotic Satellites near the Straight-line Equilibrium Points in the Problem of Three Bodies. Pp. 79-110. D. BUCHANAN. *Concerning the Invariant Theory of Involutions of Conics.* Pp. 111-122. W. SENSENIG. *Note on Seminvariants of Systems of Partial Differential Equations.* Pp. 123-132. A. L. NELSON. *On a Method for Determining the Non-Stationary State of Heat in an Ellipsoid.* Pp. 133-142. B. DATTA. *Nilpotent Algebras generated by Two Units, i and j, such that i^2 is not an Independent Unit.* Pp. 143-164. G. W. SMITH.

The American Mathematical Monthly.

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The Content of a Second Course in Calculus. Pp. 429-434. *A System of Algebraic and Transcendental Equations.* Pp. 435-440. G. N. BAUER and H. L. SLOBIN. *Practical Solution*

of Linear Equations. Pp. 441-444. H. T. BURGESS. *Undergraduate Mathematics Clubs.* Edited by R. C. ARCHIBALD. Pp. 448-463.

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Leonardo of Pisa and his Liber Quadratorum. Pp. 1-8. R. B. MACLENON. *On the Form of the Power Series for an Algebraic Function.* Pp. 9-12. E. J. WILCZYNSKI. *Concerning a Method for finding a Particular Integral.* Pp. 12-15. A. B. COBLE. *Who was the first Inventor of the Calculus?* Pp. 15-20. F. CAJORI. *Concerning a New Method for Tracing Cardioids.* Pp. 21-32. W. F. RIGGE. *Statistics in Relation to the War.* Pp. 32-35. R. H. VIVIAN.

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On Certain Constructions of Descriptive Geometry. GINO LORIA. Pp. 45-53. *Difference Quotients.* J. P. BALLANTINE. Pp. 53-59. *A Theorem on the Geometry of the Triangle.* J. W. CLAWSON. Pp. 59-62. *On an Elementary Problem of Closure on an Equilateral Hyperbola.* A. EMCH. Pp. 63-65. Discussion: *Concerning Haversines in Plane Trigonometry.* Pp. 69-72. G. W. EVANS.

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On the Envelope of the Wallace Lines of an Inscribed Quadrangle. Pp. 108-111. D. F. BARROW. *Geometrical Explanation of a Certain Optical Phenomenon.* Pp. 111-112. W. H. ROEVER.

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X. No. 4. 1915.

Sobre as series dos potenciais. Pp. 193-204. J. P. TEIXEIRA. *Sui metodi di risoluzione del problema lunare.* Pp. 205-236. C. ALASIA.

X. No. 1. 1916.

Sur différents procédés d'approximation. Pp. 5-35. A. AUBRY. *Quelques considérations sur les systèmes de formes linéaires.* Pp. 58-64. V. GRADARA.

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X. 3. 1916.

Sur l'aire d'une segment de courbe convexe. Pp. 129-140. E. TURRIÈRE. *Essai d'une théorie analytique des lignes non-euclidiennes.* Pp. 141-146. G. PIRONDINI. *Notas sobra Vernier.* Pp. 147-154. A. C. PEREIRA.

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Sur l'aire d'une courbe plane générale. Pp. 5-11. E. TURRIÈRE. *Sur une intégrale définie dont l'élément est une exponentielle de degré 4.* Pp. 12-13. P. APPELL. *Sobre a construcçao das tangentes a cissoide obliqua que passam por un ponto exterior a curva.* Pp. 14-17. F. G. TEIXEIRA. *L'équation tangentielle polaire des courbes de Cesàro.* Pp. 18-26. L. BRAUDE.

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Los problemas de la mecánica. Pp. 94-112. E. TERRADAS. *Rapport de M. Appell sur les travaux de M. F. G. Teixeira.* Pp. 126-128.

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Sur la réprésentation géométrique de la torsion d'une courbe gauche. Pp. 218-224. E. TURRIÈRE.

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The Gamma Function in the Integral Calculus (concluded). Pp. 77-124. T. H. GRONWALL. *Invariants which are Functions of Parameters of the Transformation.* Pp. 125-135. O. E. GLENN. *A Theorem on Exhaustible Sets connected with Developments of Positive Real Numbers.* Pp. 136-141. H. BLUMBERG. *Solution of the Differential Equation* $dx^2+dy^2+dz^2=ds^2$ *and its Application to some Geometrical Problems.* Pp. 142-148. A. PELL. *A General Method of Summation of Divergent Series.* Pp. 149-154. L. L. SMAIL.

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On Quaternions and the Generalization and the History of the Eight-Square Theorem. Pp. 155-171. L. E. DICKSON. *Non-Symmetric Kernels of Positive Type.* Pp. 172-176. C. E. SHELY. *Elementary Properties of the Stieltjes Integral.* Pp. 177-186. H. E. BRAY. *A Kinematical Property of Ruled Surfaces.* Pp. 187-190. J. K. WHITTEMORE. *Systems of Linear Inequalities.* Pp. 191-199. LL. L. DINES. *On the Shortest Line between Two Points in Non-Euclidean Geometry.* Pp. 200-201. T. H. GRONWALL. *The Generalized Gamma Function.* Pp. 202-217. E. L. POST. *On the most General Plane Closed Point-set through which it is possible to pass a Simple Continuous Arc.* Pp. 218-223. R. L. MOORE and J. R. KLINE. *Repeated Integrals.* Pp. 224-228. D. C. GILLESPIE.

Bulletin of the American Mathematical Society.

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General Aspects of the Theory of Summable Series. Pp. 97-131. R. D. CARMICHAEL. *On the Problem of the Resistance Integral.* Pp. 131-132. T. HAYASHI. *Note on Editions of Von Staudt's Geometrie der Lage.* Pp. 132-134. R. C. ARCHIBALD. *Mathematical Periodicals.* Pp. 134-137. R. C. ARCHIBALD.

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Applications of the Theory of Summability to Developments in Orthogonal Functions. Pp. 258-276. C. N. MOORE. *Modular Systems.* Pp. 276-279. R. D. CARMICHAEL.

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Intermédiaire des Mathématiciens. Jan.-Dec., 1918.

Le cubiche gobbe aventi ciascuna all' infinito tre punti reali e distinte. Pp. 82-129. GINO LORIA. (Reprint from *Scritti matematici offerti ad E. d'Ovidio*, Torino, Bocca, 1918.)

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Infinite Series and Arithmetical Functions. Pp. 454-472. F. H. HALBERG. *Note on Triangles inscribed in an Ellipse.* Pp. 473-475. A. N. RAGAVACHAR. *On Poristic Polygons.* Pp. 475-476. F. H. V. GULASEKHARAM. *Given circumcentre and orthocentre, find loci of in- and ex-centres.* Pp. 476-478. M. T. NARANIENGAR.

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Sur les foyers rationnels d'une courbe algébrique plane ou gauche. Pp. 401-402. P. APPELL. *Sur les courbes algébriques planes.* Pp. 403-417. R. BOUVAIST. *Sur deux points du plan d'un triangle et sur une généralisation des points de Brocard.* Pp. 417-424. R. GOORMAGHTIGH. *Quelques applications géométriques de la théorie des infiniment petits.* Pp. 424-429. M. WEILL. *Nouvelles identités* (cf. N.A. 1917, pp. 456-462). Pp. 430-431. G. FONTENÉ. *Sur la chaînette d'égale résistance* (cf. N.A. 1917, p. 361). Pp. 431-433. F. BALITRAND.

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Sur les troisième et quatrième centres de courbure des courbes de Cesàro. Pp. 441-445. R. GOORMAGHTIGH. *Sur un problème concernant des groupes de points sur l'hyperbole équilatère.*

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Progressive Science and Mathematics Courses and Teaching in France. Pp. 199-204. A. BARTHELEMY.

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